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C&SF Comprehensive Review Study B Alternative 4

Component A4

Geographic Region: North of Lake Okeechobee

Component Title: Storage Reservoir (modified from Alternative 3 to use Climate-based operational rules) – SEE COMPONENT FIGURE 1

Purpose: To increase the capacity of the hydrologic system to better meet the water management objectives associated with flood protection, water supply and environmental enhancement. The additional water storage capacity allows for greater detention of water during wet periods for subsequent use during dry periods. It is also anticipated that this increased storage capacity will shorten the duration and frequency of both high water levels in the Lake that are stressful to the Lake littoral ecosystems, and large discharges from the Lake that are disruptive to the downstream estuary ecosystems.

Operation: Water from Lake Okeechobee is to be pumped into the north storage reservoir when the climate-based inflow forecast projects that the Lake water level will rise significantly above those levels that are desirable for the Lake littoral zone (15.0-14.5 feet, NGVD; Figure 1). During the dry season, flows will be allowed back to the Lake from the reservoir when the Lake level is projected to fall to within three-quarters of a foot of the supply-side management line the same dry season, or below 11.75 feet the upcoming wet season. During the wet season, flow is allowed from the reservoir to the Lake when climate-based inflow forecast projects less than 1.5 million acre-feet of inflow during the next 6 months and the Lake water level is either currently below 11.75 feet (NDVD) or projected to be in supply-side management during the upcoming dry season.

Design:

20,000 acres at 10 feet maximum depth

Inflow pump capacity = 4800 cfs

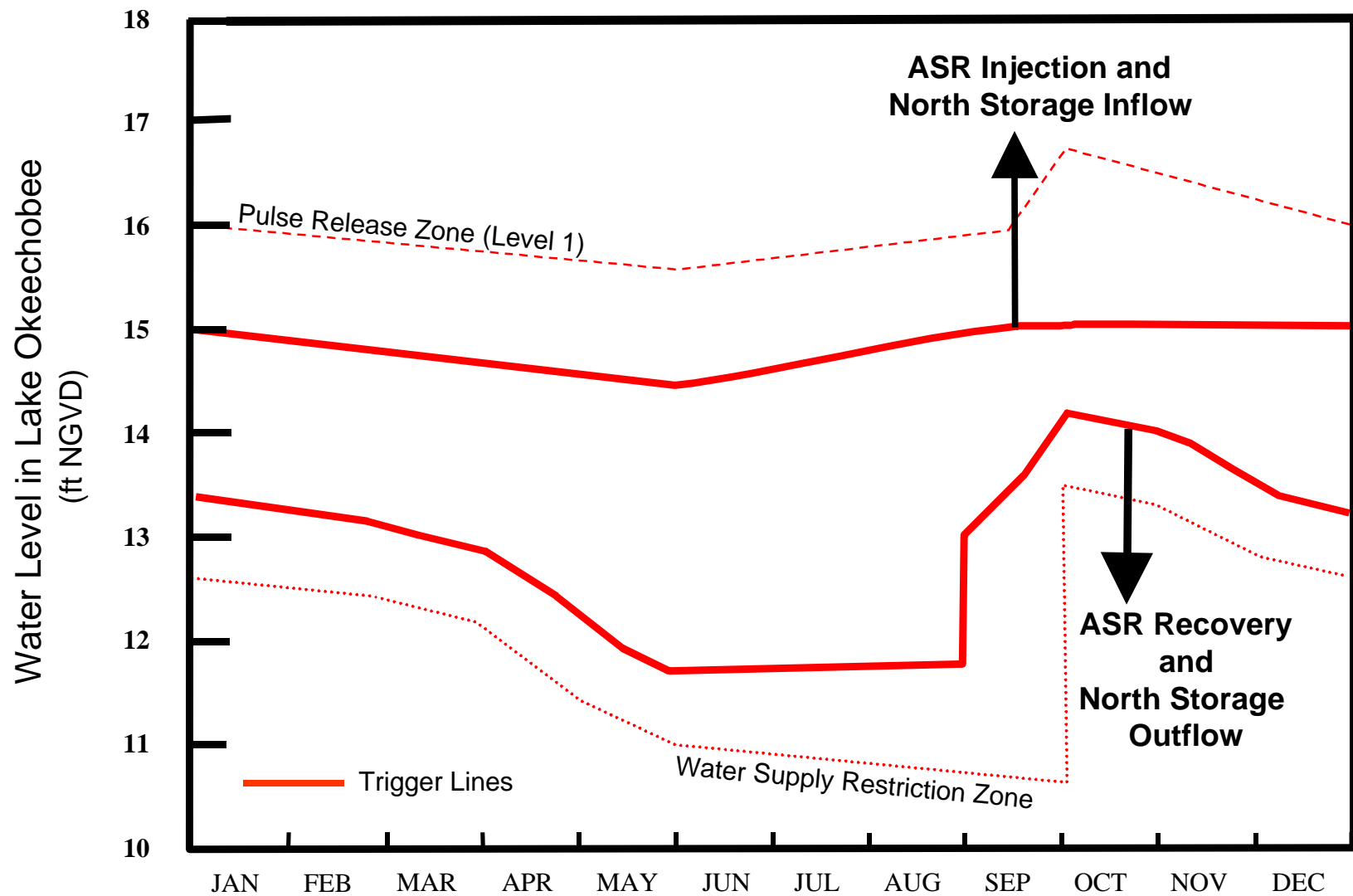
Outflow structure = 4,800 cfs

Location: To Be Determined – Specific site not necessary for Water Management Model simulation
Counties: Glades, Highlands, Okeechobee, Osceola, and Polk

Assumptions and related considerations:

- (1) Uncertainty in land availability
- (2) An alternative to capturing Lake water would be to attenuate flood waters before reaching the Lake. This could be done north of the Kissimmee River which could have positive impacts to the Kissimmee River Restoration Project or within the Taylor Creek/Nubbin Slough which would improve water quality entering the lake.
- (3) Potential increase in stage duration of Lake Okeechobee.
- (4) Potential decrease in maximum stages of Lake Okeechobee

Figure 1. Trigger Lines for North of Lake Okeechobee Storage and Lake Okeechobee Aquifer Storage and Recovery (ASR)



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Component B2

Geographic Region: St. Lucie/C-44 Basin

Component Title: Storage Reservoir (same as Alternatives 2 and 3)

Purpose: Storage reservoir to capture local runoff from C-44. The reservoir will be designed for flood flow attenuation to the estuary, water supply benefits including environmental water supply deliveries to the estuary, and water quality benefits to reduce salinity and nutrient impacts of runoff to the estuary.

Operation:

Inflows from C-44 basin runoff (and only when Lake stage is > 14.5 ft)

Design:

10,000 acres at 4 feet maximum depth

Inflow pump capacity = TBD (initially assumed to not constrain performance)

Outflow structure capacity = TBD (initially assumed to not constrain performance)

Location: To be determined – Specific site not necessary for Water
Management Model simulation

Counties: Martin

Assumptions and related considerations:

(1) Uncertainty in land availability

(2) Potential water quality benefits by reducing nutrient loading to the estuary

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Component C1

Geographic Region: St. Lucie/C-44 Basin

Component Title: Environmental Water Supply Deliveries to St. Lucie Estuary
(same as Alternatives 1, 2 and 3)

Purpose: To provide freshwater flow to the St. Lucie Estuary to protect and restore more natural estuarine condition.

Operation: Deliver estuary target discharge through S-80 from the storage reservoir when water is available or from the Lake when the Lake stage exceeds 15 feet.

Design: Operational change only

Location: C-44 and St. Lucie Estuary

Assumptions and related considerations:

(1) Target Estuary delivery based on maintaining salinity conditions in the estuary to support Oyster community

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Component D3

Geographic Region: Caloosahatchee/C-43 Basin

Component Title: Storage Reservoir(s) with Aquifer Storage and Recovery (ASR)
(same as Alternative 3)

Purpose: Storage reservoir(s) with ASR to capture basin runoff and releases from Lake Okeechobee. These facilities will be designed for water supply benefits, some flood attenuation, and to provide base flows to the Caloosahatchee estuary.

Operation: Inflows from Lake Okeechobee regulatory discharges and runoff from C-43 basin will be captured by both the reservoir(s) and ASR wellfields simultaneously. ASR wellfields will continue capture excess water even after reservoir(s) are full. Water from reservoir(s) will be used to supplement irrigation demands from Lake Okeechobee and provide water supply deliveries to the Caloosahatchee estuary when lake stages are below 15.00 feet NGVD (Caloosahatchee estuary demands are met from Lake Okeechobee when lake stages are above 15.00 feet NGVD). The ASR facilities will also be used to supplement irrigation demands but have a priority of meeting minimum flows to the Caloosahatchee estuary during times when Lake Okeechobee stages are below 15.00 feet NGVD.

Design:

Reservoir(s) total of 20,000 acres at 8 feet maximum depth.
ASR wellfields total of 22, 10-MGD wells

Reservoir(s) Inflow pump capacity = TBD (assumed not to constrain performance)

ASR inflow capacity = limited to 220 MGD

Reservoir(s) outflow structure capacity = TBD (assumed not to constrain performance)

ASR outflow capacity = limited to 220 MGD

Location: TBD - Specific site not necessary for simulations

Counties: Hendry, Glades, Lee

Assumptions and related considerations:

- 1) Uncertainty in land availability.
- 2) Potential water quality benefits by reducing nutrient loading.

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- 3) Raw water ASR injection permissible.
- 4) 70 percent recovery for injected ASR water.
- 5) Size of injection bubble not limited.
- 6) ASR facility sized to slightly exceed minimum flows to estuary.

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Component E1

Geographic Region: Caloosahatchee/C-43 Basin

Component Title: Environmental Water Supply Deliveries to Caloosahatchee Estuary (same as Alternatives 1, 2 and 3)

Purpose: To provide freshwater deliveries to the Caloosahatchee Estuary to establish desirable salinity at locations of key estuarine biota.

Operation: Deliver desired estuary target flow through S-79 from the storage reservoir when water is available or from the Lake when the Lake stage exceeds 15 feet.

Design: Operational change only

Location: C-43 and Caloosahatchee Estuary

Assumptions and related considerations:

(1) Estuary deliveries based on maintaining salinity conditions in the estuary to support a range of aquatic vegetation seagrass, invertebrates, and fish communities.

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Component F3

Geographic Region: Lake Okeechobee

Component Title: Lake Okeechobee Regulation Schedule (same as Alternative 3)

Purpose: Operating criteria for Lake Okeechobee that includes flood control, water supply (including releases to the Water Conservation Areas to meet estimated natural system needs), and Lake littoral zone and estuary protection.

Operation: Use current regulation schedule (known as Run 25) with the exception of eliminating all St. Lucie and Caloosahatchee regulatory discharges (except emergency releases - zone A).

Design: Operational change only. Modify the regulation schedule by eliminating all but emergency discharges to both the St. Lucie and Caloosahatchee Estuaries.

Location: Within existing boundary of Lake Okeechobee
Counties: Glades, Hendry, Martin, Okeechobee, and Palm Beach

Assumptions and related considerations:

(1) It is assumed that the implementation of other project components will reduce the frequency of high Lake stage events therefore reducing the need for regulatory releases to the St. Lucie and Caloosahatchee Estuaries.

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Component G3

Geographic Region: Everglades Agricultural Area (EAA)

Component Title: Storage Reservoir (same as Alternative 3)

Purpose: Storage reservoir to: improve timing of environmental deliveries to the Water Conservation Areas including reducing damaging flood releases from the EAA to the Water Conservation Areas; reduce Lake Okeechobee regulatory releases to estuaries; to meet supplemental agricultural irrigation demands; and increase flood protection within the Everglades Agricultural Area. Conveyance capacity of the Miami and North New River Canals between Lake Okeechobee and the Storage Reservoirs are increased to convey additional Lake Okeechobee flood control releases that would have otherwise been discharged to the Caloosahatchee and St. Lucie Estuaries.

Operation: Inflows are from Lake Okeechobee regulatory discharges and runoff from Miami & North New River canal basins. The reservoir will be divided into two compartments.

Compartment 1: 20,000 acres, meets EAA irrigation demands only. The source of water is excess EAA runoff (inlet capacities for excess runoff (2700 and 2300 cfs) and outlet capacities for EAA demands same as Alternative 2). Overflow to compartment 2 occurs when depth of water in compartment approaches 6 ft maximum and Lake Okeechobee regulatory discharges are not occurring or impending. Excess EAA runoff is diverted to this compartment ONLY if WCA-3A is too deep.

Compartment 2: 40,000 acres, meets environmental demands as a priority, but can supply a portion of EAA irrigation demands if environmental demands equal zero. The sources of water are overflow from compartment 1 and Lake Okeechobee regulatory releases.

The conveyance of the northern reaches of the Miami and North New River Canals in the EAA are tripled for Lake Okeechobee regulatory releases as in Alternative 3. Structures with a capacity of 4500 cfs for regulatory releases from Lake Okeechobee via Miami Canal and a capacity of 3000 cfs for releases via North New River Canal are added for Compartment 2. When the reservoir depths fall below 0.0 feet, Lake Okeechobee is used for meeting these demands. The flows will be delivered to the Water Conservation Areas through Stormwater Treatment Areas 3 and 4.

Design:

Compartment 1: 1-20,000 acre reservoir at 6 ft maximum depth

Inflow structure capacity: inflow pumps of 2700 cfs Miami Canal Basin and 2300 cfs North New River Canal Basin for diversion of EAA runoff

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Outflow structure capacity:

To Everglades Agricultural Area: 1-3000 cfs structure to Miami Canal Basin and 1-4400 cfs structure to North New River and Hillsboro Basins (initially assumed to not constrain performance).

Compartment 2: 1-40,000-acre reservoir at 6 ft maximum depth

Inflow structure capacity:

inflow pumps of 4500 cfs and 3000 cfs for diversion of Lake Okeechobee regulatory releases

Outflow structure capacity:

To Stormwater Treatment Areas 3 and 4: 3600 cfs @ 6 ft head.
Increase in Miami & North New River Canal capacities (200%)
To Miami Canal: 4500 cfs
To North New River Canal: 3000 cfs

Location: To be determined - conceptually located between Miami & North New River Canals for Water Management Model simulation purposes only.
Counties: Palm Beach

Assumptions and related considerations:

(1) Land Availability

(2) Modifications to Stormwater Treatment Areas if needed for Everglades water deliveries to meet the appropriate water quality.

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Component H4

Geographic Region: Water Conservation Areas and Everglades National Park

Component Title: Everglades Rain-Driven Operations (similar to Alternative 3; exceptions described below)

Purpose: Improve timing and location of water depths in the Water Conservation Areas (WCA) and Everglades National Park (ENP).

Operation:

WCA-1: No rain-driven operations for inflows or outflows (use regulation schedule)

WCA-2: Import water from Lake Okeechobee via STA-2 if either condition occurs:

- a. water levels in northern 2A fall more than 0.2' below target levels.
- b. water levels at 2A-17 fall below target levels.

WCA-2:

- a. Export water from WCA-2A via the S-11's if levels rise more than 0.2' above target; max discharge if levels rise more than 0.4' above target.
- b. Export water from WCA-2B to Central Lakebelt storage via new structures at south end of WCA-2B. Discharge begins when levels rise more than 0.25' above target; max discharge if levels rise more than 0.5' above target.

WCA-3:

- a. Import water from EAA storage and/or Lake Okeechobee via STA-3/4 to:
 - (1) Northeast WCA-3A if levels fall more than 0.2' below target at 3A-NE.
 - (2) Northwest WCA-3A (via L-5/L-4, S8, G404, and spreader along L-4) if levels fall more than 0.1' below target at 3A-NW.
 - (3) West-central WCA-3A (via L-28 and a spreader along southernmost ~8 miles of L-28 {north}) if levels fall more than 0.25' above target at 3A-4.
- b. Import water from WCA-2 via S-11's if levels fall more than 0.1' below target at 3A-3 (and WCA-2 has excess water {levels at 2A-17 more than target}).

Design: Deliveries from upstream sources (EAA runoff, EAA storage area, and/or Lake Okeechobee) through the Stormwater Treatment Areas (STAs) prior to release into the WCAs. Distribution of STA outflow designed to improve hydropatterns. Flows to ENP are uncontrolled in this alternative since the water control structures and internal levees/canals are removed.

Location: Within the existing boundaries of the WCAs and ENP.

Counties: Broward, Dade, Monroe, and Palm Beach

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Assumptions and related considerations:

- 1) Consideration given to tree islands and minimum floor levels consistent with SFWMD's proposed minimum flows and levels for these areas.
- 2) Potential increases in hydropatterns in dry areas and decrease in hydropatterns in deep water areas

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Component I3

(not included in Alternative 4)

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Component J

(not included in Alternatives 2, 3 or 4)

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Component K4

Geographic Region: Water Preserve Area - Palm Beach County

Component Title: L-8 Project (modified from Alternative 3 to include the addition of 25 mgd of ASR capacity at Lake Mangonia) - SEE COMPONENT MAP 1

Purpose: Reduce water supply restrictions in the Northern Palm Beach County Service Area by capturing more of the annual discharges from portions of the southern L-8, C-51 and C-17 basins and route this water to the West Palm Beach Water Catchment Area (WPB WCA). Intent is to increase water supply availability and provide pass through flow to enhance hydroperiods in Loxahatchee Slough and increase base flows to the Northwest Fork of the Loxahatchee River.

Operation: Capture excess L-8, C-51 and C-17 basin water to meet urban water supply demands in the Northern Palm Beach County Service Area and enhance hydroperiods in the Loxahatchee Slough. Water would be diverted through the M-canal to the Water Catchment Area. Stormwater treatment areas will be provided to meet all water quality standards required if necessary.

Design:

- Add 25 mgd of ASR clusters at Lake Mangonia to provide water during regionally triggered droughts and as a means of reducing withdrawals from the WPB WCA when the water levels are substantially below the target hydrograph. During period when the WPB WCA is above 18.0 feet NGVD an additional (above the flow rate required to supply the water treatment plant) 25 mgd (39 cfs) will be sent to Lake Mangonia for subsequent storage through the ASR Clusters (surficial well discharging into a Floridan well). The ASR well will provide water directly to Lake Mangonia when water levels in the WPB WCA are within 0.2 feet of the level that triggers regional supply to the WPB WCA.
- Increase the pumping capacity from the L-8 Tieback into the M-Canal to 300 cfs to increase the volume of water captured from the southern L-8 canal and deliver it to the Water Catchment Area. This pump has dual purpose, 1) to capture L-8 basin runoff when available and 2) to deliver regional deliveries when needed.
- Assume that the Indian Trail Improvement District will adopt an operation plan which promotes water conservation by prioritizing discharge so that excess storm water is first offered to the City of West Palm Beach Water Catchment Area and secondarily discharged through off peak releases to the C-51 Canal via the M-1 Canal. For this alternative pumping from Indian Trail Improvement

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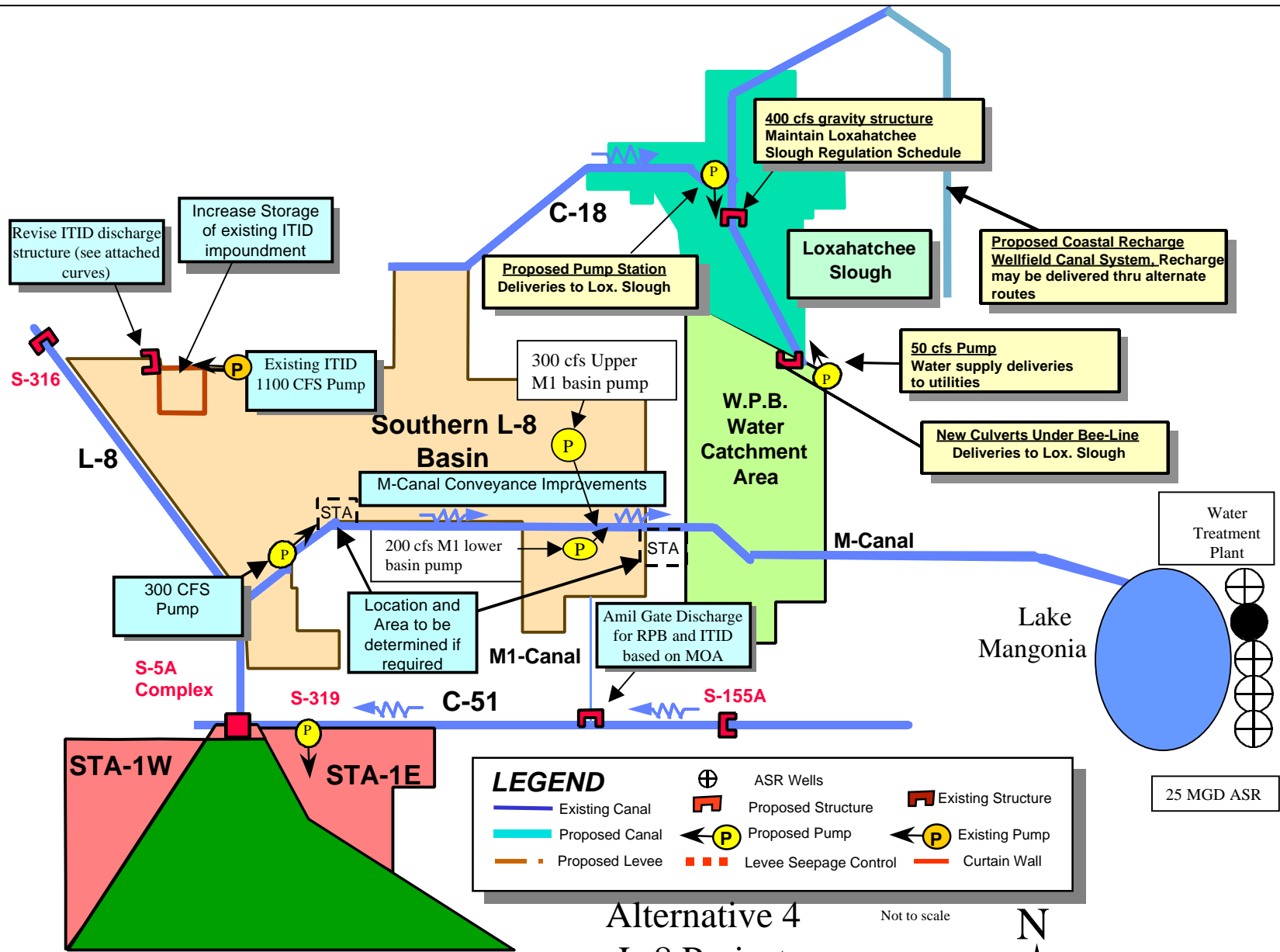
District into the M-Canal for subsequent discharge into the City of West Palm Beach Water Catchment Area will be assumed to occur under the following conditions

- When the City of West Palm Beach Water Catchment Area has sufficient need for imported water as defined by being below 18.2 feet NGVD.
 - When water levels in the Lower M-1 Basin exceed 14.0 feet NGVD during the wet season (June 1 through October 31) or 16.0 feet NGVD during the dry season (November 1 through May 31) the Lower M-1 Basin may discharge up to 200 cfs for subsequent storage.
 - When water levels in the Upper M-1 Basin exceed 15.0 feet NGVD during the wet season or 16.0 feet NGVD during the dry season) the Upper M-1 Basin may discharge up to 300 cfs for subsequent storage.
- Increase conveyance of the M-canal between the pump and the Water Catchment Area to accommodate the increased inflow from the L-8 Canal and the Indian Trail Improvement District.
 - Install a new structure in the south leg of C-18 just south of the west leg to facilitate better management of water levels and discharges from the Loxahatchee Slough. The new gravity structure would consist of a variable discharge up to 400 cfs and emergency overflow weirs.
 - 50 cfs pump for water supply deliveries to utilities.
 - New culverts under Bee-Line Highway for up to 100 cfs deliveries to Loxahatchee Slough.
 - Eliminate ASR component described in the Future Without Project Condition

Location: Southern L-8 Basin including the Indian Trail Improvement District, West Palm Beach Water Catchment Area, and the Loxahatchee Slough
Counties: Palm Beach

Assumptions and related considerations:

- 1) Should help maintain stages in the Loxahatchee Slough and reduce high discharges to the southwest fork of the Loxahatchee River.
- 2) Stormwater Treatment Area upstream of the Water Catchment Area may be needed to accommodate future degradation of water quality.
- 3) Secondary structures (recharge canals) may be needed downstream of the Water Catchment Area to provide water to achieve the desired result.



Alternative 4
L-8 Project
Component Map 1

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Component L3

Geographic Region: Lower East Coast Service Area

Component Title: Change coastal wellfield operations (same as Alternative 3)

Purpose: Shift demands from eastern wellfields to western facilities away from the saltwater interface to reduce impact of salt water intrusion.

Operation: For coastal utilities in the Lower East Coast Service Area which are experiencing an increased threat of saltwater intrusion, demands will be shifted from the eastern facilities to the western facilities away from the saltwater interface. The volume shifted is dependent upon the degree of saltwater intrusion but is generally proportional to the increase in demands between the 1995 existing conditions and the 2050 future without project conditions unless otherwise noted.

Design: For this alternative the following utilities have a portion of their demands shifted inland and include Riviera Beach, Lake Worth, Lantana, Manalapan, Boca Raton, Hollywood (including Broward County 3B and 3C), Dania, Miramar, Broward County 3A, Hallandale and Florida City. Redistribution of demands for Lake Worth, Lantana, Manalapan, Boca Raton and Florida City are generally consistent with the Lower East Coast Water Supply Plan. For the City of Riviera Beach, demands will be shifted from the eastern facilities to the western facilities with the western facilities absorbing the increased demand between the 1995 and 2050 conditions. For this alternative, the City of Miramar's eastern wellfield will be placed on standby and all demands will be met from the western wellfield. For the City of Hollywood, Hallandale, Dania, Broward County 3A, and Broward County 3B/3C all these wellfields will be placed on standby and the entire demand (with the exception of 4 MGD from the Floridan aquifer for Hollywood) will be met from the South Broward County Regional wellfield. Recharge to the Regional wellfield will be met through the existing canal system supplied from locally captured runoff from the C-9 Basin (Components R and S).

Location: Lower East Coast Service Area.

Counties: Broward, Dade and Palm Beach.

Assumptions and related considerations:

1) It is assumed that the western facilities of the individual utilities have sufficient capacity to meet the increased demands.

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Component M4

Geographic Region: Water Preserve Area - Palm Beach County

Component Title: Site 1 Impoundment (Modified from Alternative 3 to include additional Aquifer Storage and Recovery (ASR) wells) – SEE COMPONENT MAP 2

Purpose: Water supply storage reservoir to supplement water deliveries to the Hillsboro Canal during the dry-season.

Operation: The reservoir will be filled during the wet-season from excess water in Hillsboro Canal (backpumped). Water will be released back to Hillsboro Canal to help maintain canal stages during the dry-season. If water is not available in the reservoir, existing rules for water delivery to this region will be applied. Aquifer Storage and Recovery (ASR) is being incorporated to improve efficiency. Fifteen (15) 5 mgd capacity ASR wells will be added (total injection and recovery capacity 75 mgd). Water from the Site 1 Impoundment will be injected when stages in the impoundment are >14.0 feet NGVD (3 feet of depth in the impoundment). Water will be recovered from the ASR wells when stages in the Hillsboro Canal are <7.0 feet NGVD.

Design:

1660 acres with a maximum depth of 6 feet

Inflow pump capacity = 500 cfs

Outflow structure capacity = 200 cfs @ 4 ft. head

Emergency outflow structure = 200 cfs

Fifteen (15) – 5 mgd ASR wells (total capacity 75 mgd)

Location: The Water Preserve Area Land Suitability Analysis previously identified 1660 acre site.

Counties: Palm Beach

Assumptions and related considerations:

- 1) Excess storage could be discharged to Water Conservation Area 2A if a treatment facility could be added to meet Everglades' water quality standards.
- 2) Recovery rate of 70% efficiency for ASR wells is assumed.

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Component N2

(not included in Alternative 4)

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Component O4

Geographic Region: Water Preserve Area - Broward County

Component Title: Water Conservation Area (WCA) 3A and 3B Levee Seepage Management (Similar to Alternatives 1, 2 and 3 except seepage from WCA 3 will be directed south to the Central Lake Belt storage area and will not be returned via the S-9 pump station) – SEE COMPONENT MAPS 3 and 4

Purpose: Reduce seepage from WCAs 3A and 3B to improve hydropatterns within the Conservation Areas by allowing higher water levels in the borrow canals and longer inundation durations within the marsh areas that are located east of the WCAs and west of US Highway 27. Seepage from the WCAs and marshes will be collected and directed south into the Central Lake Belt Storage Area. This will maintain flood protection and the separation of seepage water from urban runoff originating in the C-11 Basin and Lake Okeechobee water supply deliveries.

Operation: The L-37 and L-33 borrow canals will be held at higher stages as part of the WCA 2 seepage collection and conveyance system (Component YY). Seepage collected in the L-37 and L-33 borrow canals and from the marsh areas will be directed into the WCA 2 seepage collection and conveyance system and directed south into the Central Lake Belt Storage Area or directly to North East Shark River Slough.

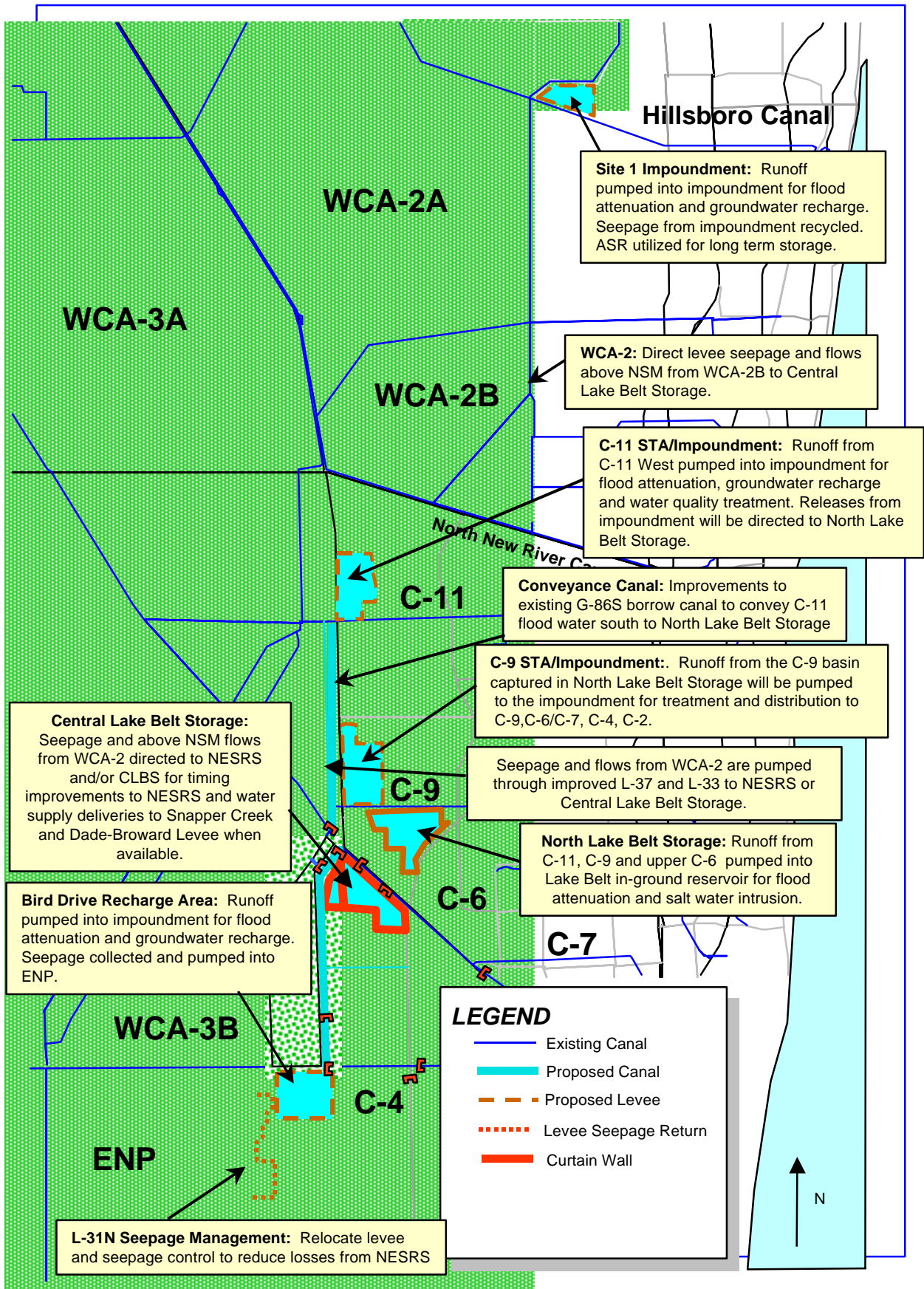
Design: New levees will be constructed west of US Highway 27 from the North New River Canal to the Miami (C-6) Canal to separate seepage water from the urban runoff in the C-11 diversion canal (Component Q). The L-37 and L-33 borrow canals will be controlled at higher stages as will the marshes located east of the WCAs. A divide structure will be added to the C-11 Canal west of US Highway 27 to maintain the separation of seepage water from urban runoff. Water from C-11 west will be diverted to the North Lake Belt Storage Area.

Location: Seepage collected in borrow canals along the existing eastern protective levees adjacent to WCA 3. Divide structure located in C-11 Canal east of US Highway 27.

Counties: Broward

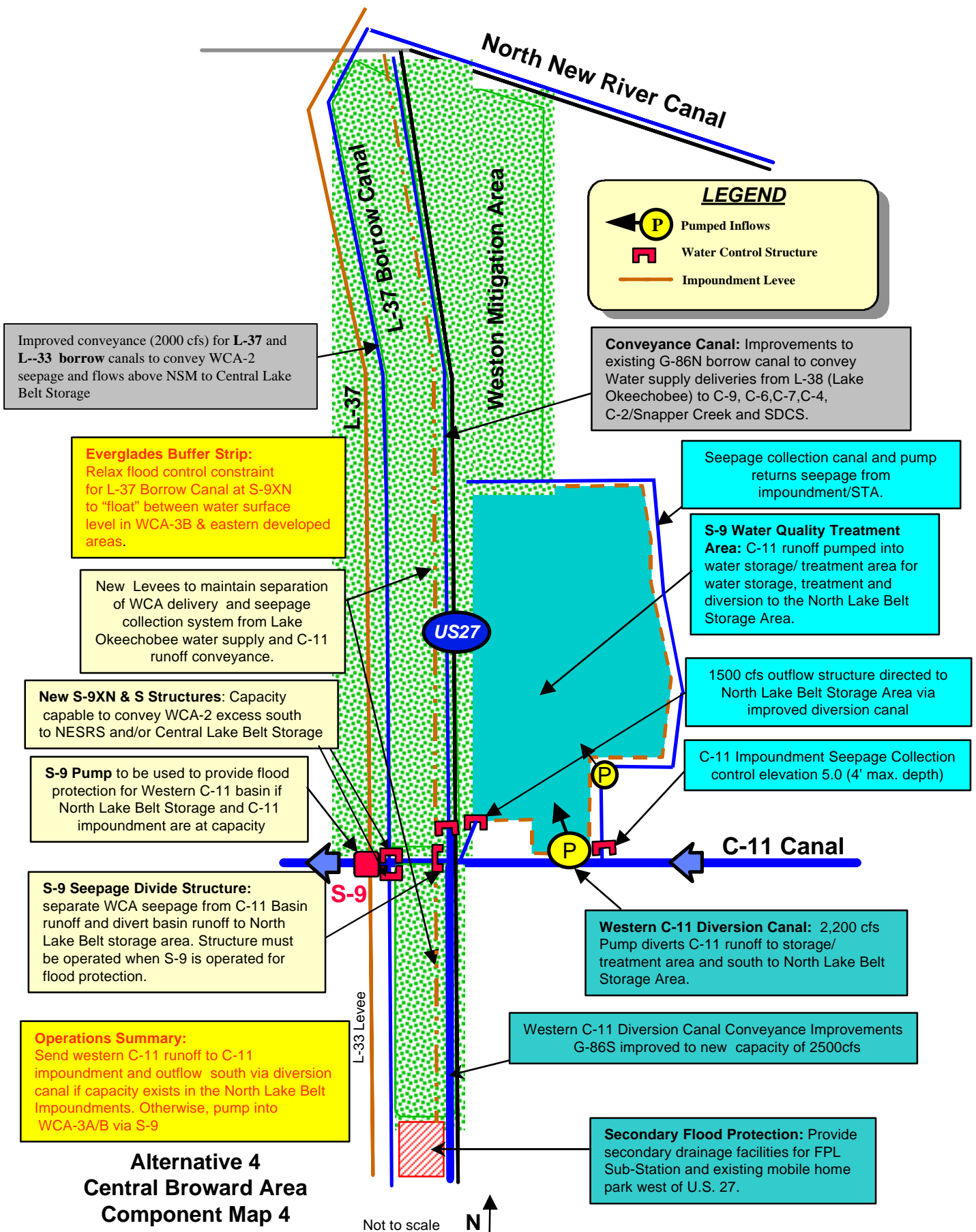
Assumptions and related considerations:

(1) It is assumed that the seepage from the Water Conservation Areas meets the water quality standards necessary to achieve ecosystem restoration.



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General Water Preserve Area Components **Alternative 4** **Component Map 3**



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Component P2

(not included in this Alternative)

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Component Q4

Geographic Region: Water Preserve Area - Broward County

Component Title: Western C-11 Diversion Impoundment and Canal -- to North Lake Belt Storage Area (NLBSA) (runoff diverted through impoundment then directed to NLBSA) B SEE COMPONENT MAPS 4 and 5

Purpose: Divert untreated runoff from western C-11 that is presently discharged into Water Conservation Area 3A through the C-11 Stormwater Treatment Area / Impoundment to the North Lake Belt Storage Area.

Operation: Runoff in the western C-11 Canal that was previously backpumped into Water Conservation Area 3A will be diverted to the C-11 STA/Impoundment and then to North Lake Belt Storage Area (NLBSA). If storage capacity is not available in the impoundment or NLBSA then the S-9 pump will be used for flood protection for the Western C-11 basin which pumps to WCA-3A.

Design:

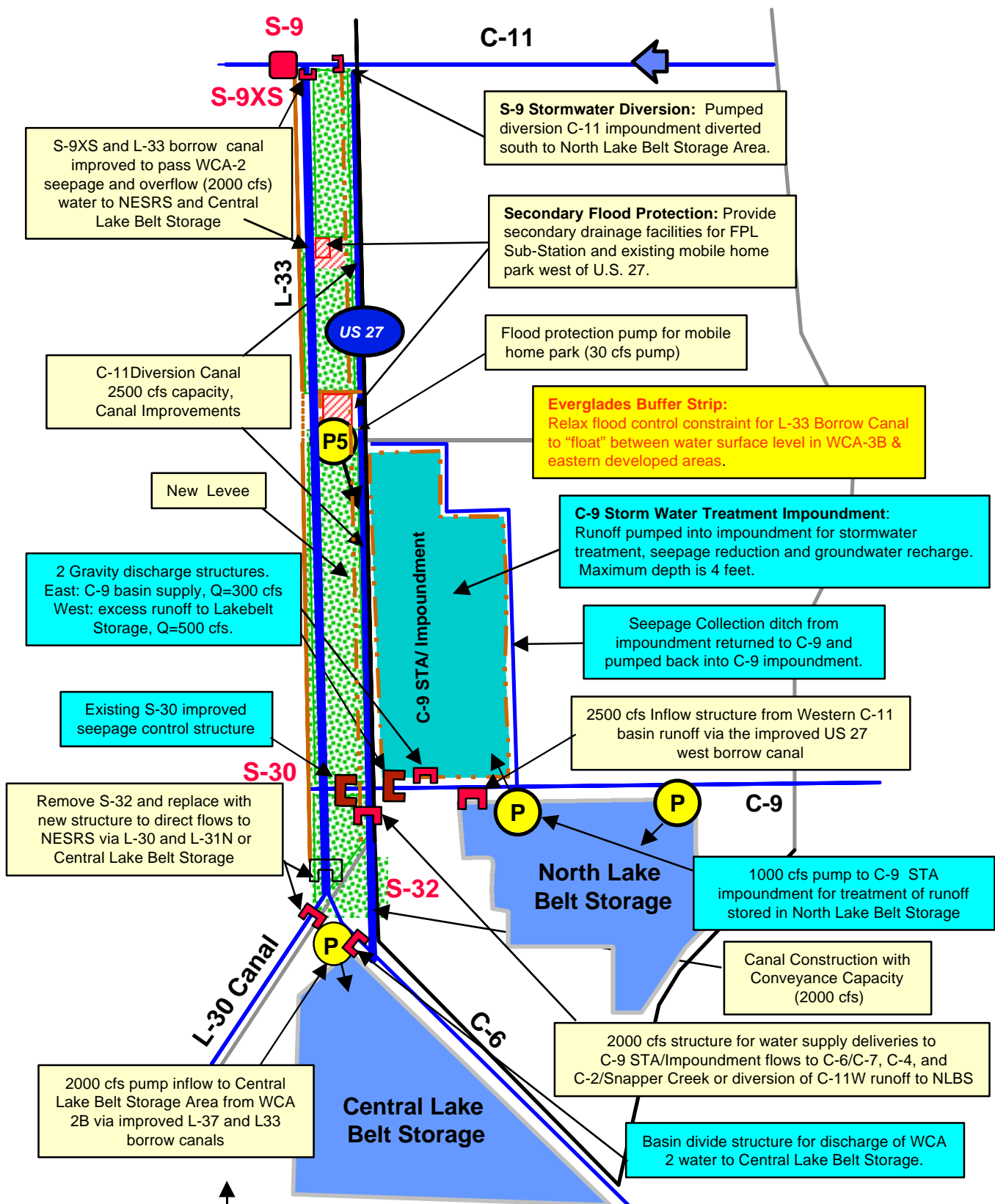
- (1) 2,500 cfs diversion canal west of U.S. 27 between C-11 and C-9 and a 2,500 cfs conveyance capacity improvements to the C-9 canal between S-30 and the NLBSA.
- (2) Intermediate 2,500 cfs pump station in the C-11 Canal to direct runoff to the C11 STA/impoundment.
- (3) 1600 acre STA/Impoundment
- (4) Seepage Collection canal and Pump for C-11 STA/impoundment.
- (5) 2500 cfs structure to discharge from the impoundment to C-11 west of US 27 to diversion canal.

Location: The diversion canal is located west of US-27 between C-11 and C-9 Canals. The C-11 STA/impoundment is located northwest of the intersection of US27 and C-11 Canal.

Counties: Broward, Dade

Assumptions and related considerations:

- 1) Flood protection component for FPL substation and mobile home park may be needed.
- 2) Telemetry systems will be required for all operable structures and pump stations.



**Alternative 4
S.W. Broward Area
Component Map 5**

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Component R4

Geographic Region: Water Preserve Area - Broward County

Component Title: C-9 Stormwater Treatment Area/Impoundment (modified from Alternatives 1 and 2. Discharges made from North Lake Belt Storage Area are directed through C-9 STA/Impoundment for water supply deliveries to C-9, C-6/C-7, C-2/C-4) SEE COMPONENT MAP 5

Purpose: Treatment of water supply deliveries from North Lake Belt Storage Area (NLBSA) to C-9, C-6/C-7 and C-2/C-4 Canals. NLBSA is used to capture runoff from western C-9 basin and C-11 west by backpumping into the curtain walled reservoir area. The C-9 impoundment will provide treatment of runoff stored in North Lake Belt Storage Area, groundwater recharge within the basin and seepage control of WCA3 and buffer areas to the west.

Operation: Water supply deliveries from North Lake Belt Storage Area to C-9, C-6/C-7 and C-2/C-4 Canals will be pumped into the C-9 STA/impoundment for treatment of the stormwater runoff stored in the NLBSA. Seepage from C-9 impoundment will be collected and returned to the impoundment.

Design:

2,500 acres with a maximum depth of 4 feet

Inflow structure: 1500 cfs pump (NLBSA) (to be resized as needed) SEE COMPONENT XX

Outflow structure: Gravity structure with 1500 cfs capacity at 4 foot head. Discharge C-9 impoundment to C-9, C-6/C-7 and C-2/C-4 Canals for water supply deliveries.

Seepage Collection: 200 cfs recycled into the impoundment area

Location: Site identified by Water Preserve Area Land Suitability Analysis
Counties: Broward

Assumptions and related considerations:

- (1) Additional treatment facility needed if stored water is backpumped into Water Conservation Area 3A.
- (2) Telemetry systems will be required for all operable structures and pump stations

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Component S4

Geographic Region: Water Preserve Area - Dade County

Component Title: Central Lake Belt Storage Area (CLBSA) - SEE COMPONENT MAP 6

Purpose: In-ground reservoir to receive excess water from Water Conservation Area 2B. The in-ground reservoir, with perimeter seepage barrier will allow storage of large quantities of water without seepage losses in this very transmissive groundwater region. The excess Water Conservation Area 2B water will be provided prioritized to 1) North East Shark River Slough (NESRS) or 2) Central Lake Belt Storage Area for deliveries to NESRS, or 3) when available to meet Snapper Creek demands and 4) to maintain Dade-Broward levee at 5.0 feet NGVD.

Operation: Inflows from L-33 (see Component XX) is through a 1500 cfs pump. Inflow ceases when stages reach ~11.0 feet, NGVD (6 feet above adjacent land elevation). Inflows from L-33 diverted to CLBSA only if NESRS water levels exceed target levels.

Outflows for water supply are pumped through a polishing marsh cell prior delivery to NESRS via L-30 and a reconfigured L-31 N (see component U). Outflow for Snapper Creek is directly to the NW Wellfield Protection Canal at the Turnpike (See Component Map 6). Outflows for the Dade-Broward Levee are directed through a polishing marsh prior to discharge to canal.

Supply from the reservoir can be withdrawn for stages down to B15 feet NGVD (up to 26 feet of working storage & maximum head on seepage barrier).

Design:

Reservoir: 5,200 acres with subterranean seepage barrier around the perimeter to enable drawdown during dry periods and to prevent seepage losses.

Inflow Structures: 1500 cfs pump from the L-33 borrow canal

Outflow Structures: 1500 cfs pump to polishing cell to make deliveries to NESRS
150 cfs gravity structure to Dade-Broward Levee.
300 cfs pump to make deliveries for Snapper Creek Canal
1100 cfs structure @0.5 ft. head to provide regional system deliveries to Snapper Creek canal via C-6 if CLBS is out of water.

Location: Reservoir would be located within the area proposed for rock mining by the Lake Belt Issue Team. It would be sited south of Miami Canal (C-6)

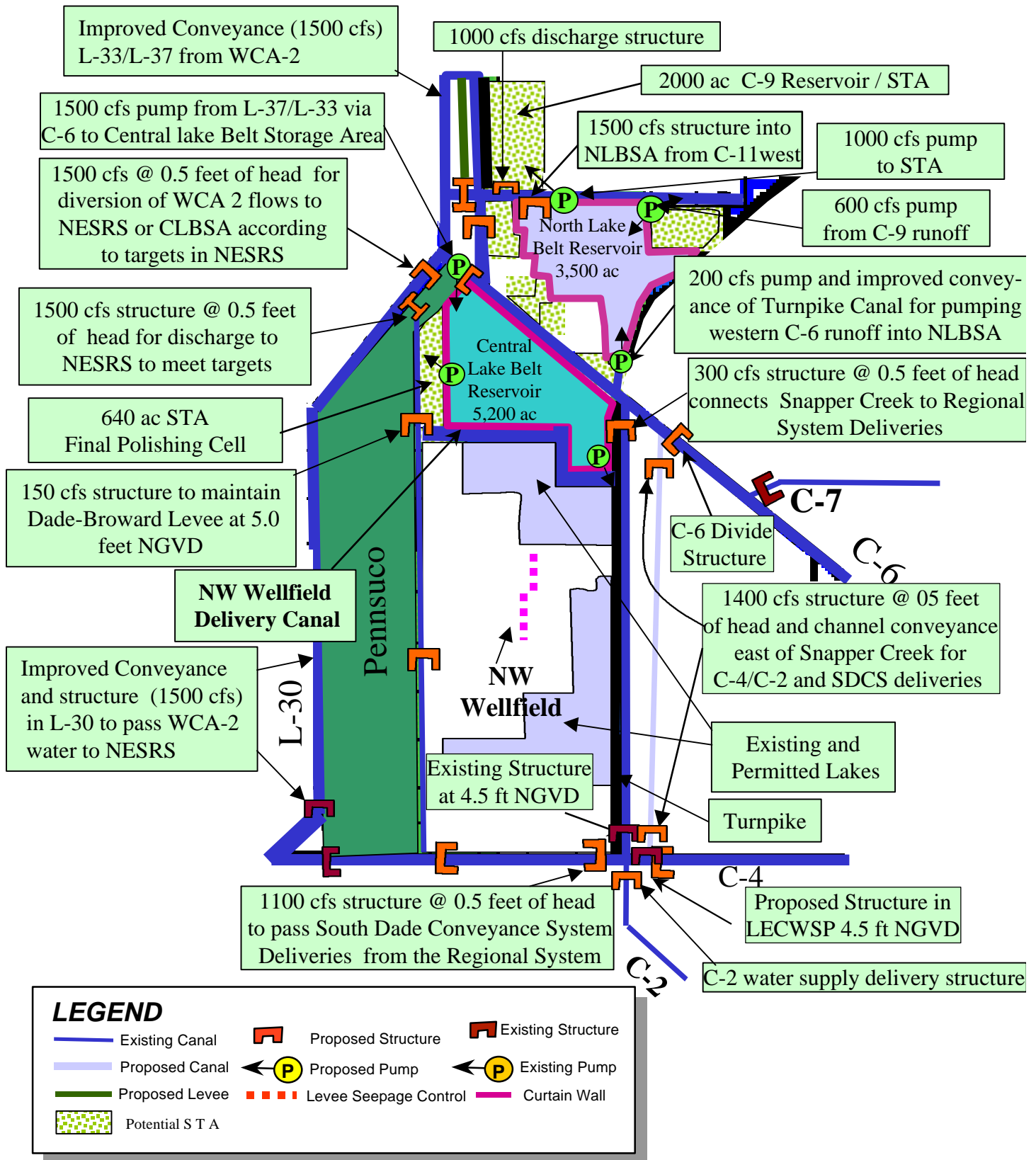
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and north of the Northwest Wellfield Delivery canal to minimize impacts to the Northwest wellfield.

Counties: Dade

Assumptions and related considerations:

- (1) No adverse effect of a subterranean wall on Dade County's NW wellfield
- (2) Treatment facility needed if stored water is backpumped to the Everglades.
- (3) All water quality considerations will be addressed regarding releases from the reservoir to the water supply wellfields.
- (4) Impacts on the cone of influence of the Northwest Wellfield and its effect on wetland mitigation around the wellfield.
- (5) Limestone Filter Treatment system within the Reservoir may be developed through use of compartmentalization of rockmining excavation pattern.
- (6) Telemetry systems will be required for all operable structures and pump stations.



Alternative 4
North and Central Lake Belt Storage Areas
Component Map 6

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Component T1

Geographic Region: Water Preserve Area – Dade County

Component Title: C-4 Structure (Same as Alternatives 1, 2 and 3).

Purpose: Proposed structure would control water levels in the C-4 Canal at higher elevation to reduce seepage losses from the Pennsuco Wetlands and areas to the west of the structure located just downstream of the Dade-Broward Levee on C-4.

Operation: The structure would maintain water levels at 6.5 feet NGVD for seepage control purposes and be capable of passing flood flows with a minimum of head loss and supplying water to the C-4 basin to meet demands.

Design: Operable Lift-gate with 6.5 feet NGVD overflow and approximately 400 cfs capacity (final design specifications will be determined in detailed design and hydrologic and hydraulic modeling in the future).

Location: Just downstream of the Dade-Broward Levee on C-4 Canal.

Assumptions and related considerations:

- (1) Benefits to WCA-3B associated with improved C-4 seepage control are directly related to the proposed G-356 pumpage (Modified Water Deliveries).
- (2) Head losses across the Proposed Structure will not inhibit passing flood releases when necessary.
- (3) A pump may be associated with this structure if back pumping the C-4 basin runoff to the Bird Drive storage area becomes a component of the final alternative.

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Component U4

Geographic Region: Water Preserve Area - Dade County

Component Title: Bird Drive Recharge Area (Modified from Alternative 3 for enhanced seepage collection) -- SEE COMPONENT MAP 7

Purpose: Capture runoff from western C-4 basin through pumping to Bird Drive recharge area to reduce seepage from the Everglades National Park (ENP) buffer areas by increasing water table elevations east of Krome Ave. The facility will provide C-4 flood peak attenuation and enhance groundwater recharge within the basin.

Operation: Inflows from western C-4 basin will be pumped into proposed Recharge Area to provide flood peak attenuation, groundwater recharge and reduce seepage from ENP buffer areas by increasing water table elevations east of the buffer areas. C-4 runoff in excess of 200 cfs pump capacity will be discharged eastward. Outflows will be used to meet C-4 needs when available. The modification of this component is routing of regional system deliveries (through the seepage collection canal system) of the Bird Drive Recharge Area to the South Dade Conveyance System (SDCS). This should reduce seepage from areas west of Krome Ave.

Design:

2,877 acres with a maximum depth of 4 feet

Inflow structure: 200 cfs pump (to be resized as needed)

Outflow structure:

Water supply: Gravity structure with 200 cfs capacity at 2 feet of head.

Seepage Collection System: 500 cfs pump to control seepage collection canal at 5.0' NGVD. Pump to L-31N.

Delivery System: 800 cfs pump to provide regional system deliveries to SDCS

800 cfs canal capacity increased in the Bird Drive seepage collection canals to pass the the regional system deliveries to the South Dade Conveyance System

5 miles of canal with 800 cfs capacity between Bird Drive seepage collection system to C-1W just east of Krome Ave.

Relocate S-338 east of Krome Ave. and delivery canal

Location: Northwestern 4 sections in Bird Drive basin. This site was identified during the Water Preserve Area Land Suitability Analysis.

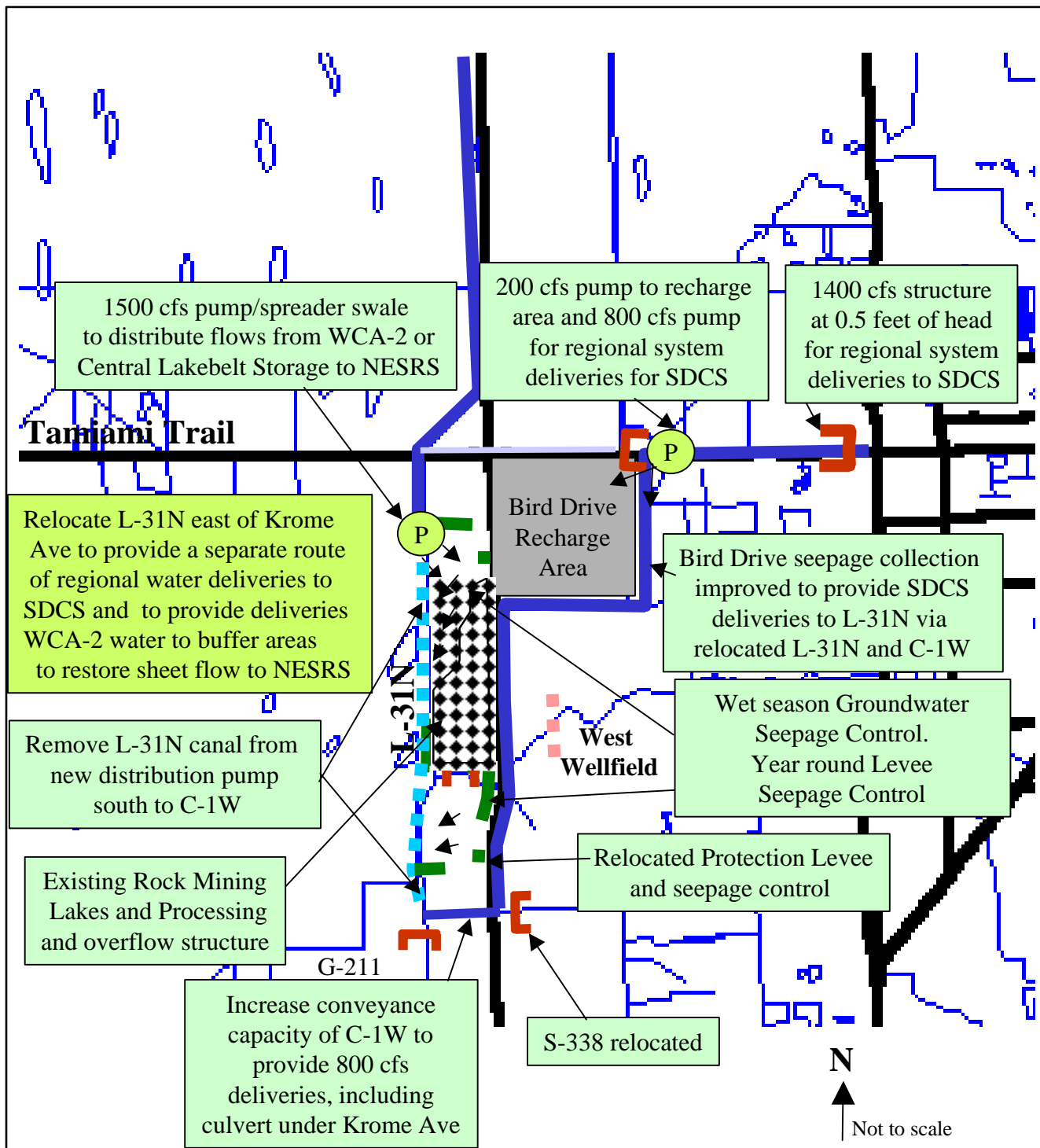
Counties: Dade

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Assumptions and related considerations:

- 1) Treatment facility needed if seepage collected does not meet Everglades standards.
- 2) Telemetry systems will be required for all operable structures and pump stations.



**Alternative 4
Bird Drive Basin
Component Map 7**

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Component V2

Geographic Region: Water Preserve Area - Dade County

Component Title: L-31N Levee Improvements for Seepage Management (Same as Alternatives 2 and 3) – SEE COMPONENT MAP 7

Purpose: Levee seepage management along the eastern edge (L-31N) of Everglades National Park to eliminate losses due to levee seepage to the East Coast. An additional feature has been added to reduce all wet-season seepage/ground water flows to the east. Feature will help restore hydropatterns in Everglades National Park.

Operation: 100% reduction in levee seepage flow from Everglades National Park year-round. Further 100% reduction in all groundwater flows during the wet-season. Bird Drive Basin and Lakebelt storage facility will be used to recharge aquifers to the east.

Design:

Levee Seepage: Sheet pile or coring material will penetrate the L-31N levee and a portion of the aquifer to retard seepage between Tamiami Trail to the 8.5 square mile area.

Wet-Season Ground Water Seepage: Distributed ground water wells adjacent to L-31N and return flows to Everglades National Park.

If needed, aquifer recharge will occur from deliveries from Bird Drive Basin and Lakebelt storage facilities.

Location: Along the existing eastern protective levee (L-31N) adjacent to Everglades National Park.

Counties: Dade

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Component W2

Geographic Region: Taylor Creek/Nubbin Slough

Component Title: Taylor Creek/Nubbin Slough Storage and Treatment Area
(same as Alternatives 2 and 3)

Purpose: Storage reservoir to provide flood protection, water quality treatment, estuary protection and water supply benefits.

Operation: Local runoff from the Taylor Creek/Nubbin Slough basins to be pumped into a 5,000-acre reservoir and then into a 5,000-acre stormwater treatment area. The stormwater treatment area will reduce phosphorus concentrations in the runoff from approximately 0.528 mg/l to 0.107 mg/l. Treated water will then be pumped into Lake Okeechobee when the lake stage is falling and is at least 0.5 feet below the bottom pulse release zone.

Design:

Storage Reservoir:

5,000-acres at 10 feet maximum depth

Inflow pump capacity 2,500 cfs

Outflow pump capacity 1,000 cfs

Stormwater Treatment Area:

5,000-acres at 4 feet maximum depth

Inflow pump capacity 1,000 cfs (same structure as reservoir outflow)

Outflow pump capacity 1,000 cfs

Location:

Counties: Okeechobee, St. Lucie

Assumptions and related considerations:

- (1) Uncertainty in land availability.
- (2) Potential increase in stage duration of Lake Okeechobee.
- (3) Potential decrease in maximum stages of Lake Okeechobee.
- (4) Phosphorus inflow concentrations (flow-weighted) for the Taylor Creek (S-191) and Nubbin Slough (S-133) Basins obtained from 5-year rolling averages (1991-1995).
- (5) Average annual discharge rates determined from the period of record 1965-1990.

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Component X3

Geographic Region: Water Preserve Area – Palm Beach County

Component Title: C-17 Backpumping (same as Alternative 3) – SEE
COMPONENT MAP 8

Purpose: Reduce water supply restrictions in Northern Palm Beach County Service Area by providing additional flows from the C-17 Basin to the West Palm Beach Water Catchment Area and enhance hydroperiods in the Loxahatchee Slough.

Operation: Capture excess C-17 Canal water to meet urban water supply demands in North Palm Beach Service Area. Water would be diverted through a canal proposed in the FPL right-of-way to a stormwater treatment area and ultimately to the West Palm Beach Water Catchment Area.

Design: 350 cfs pump on the C-17 Canal at its intersection with the FPL right-of-way

300 cfs pump in the proposed canal west of Haverhill Road to push flows southwest to the proposed stormwater treatment area

Culverts under Village Blvd., Military Trail, 45th Street, Haverhill Road and Florida's Turnpike

550 acre stormwater treatment area at 4 feet maximum depth

300 cfs pump into the proposed stormwater treatment area

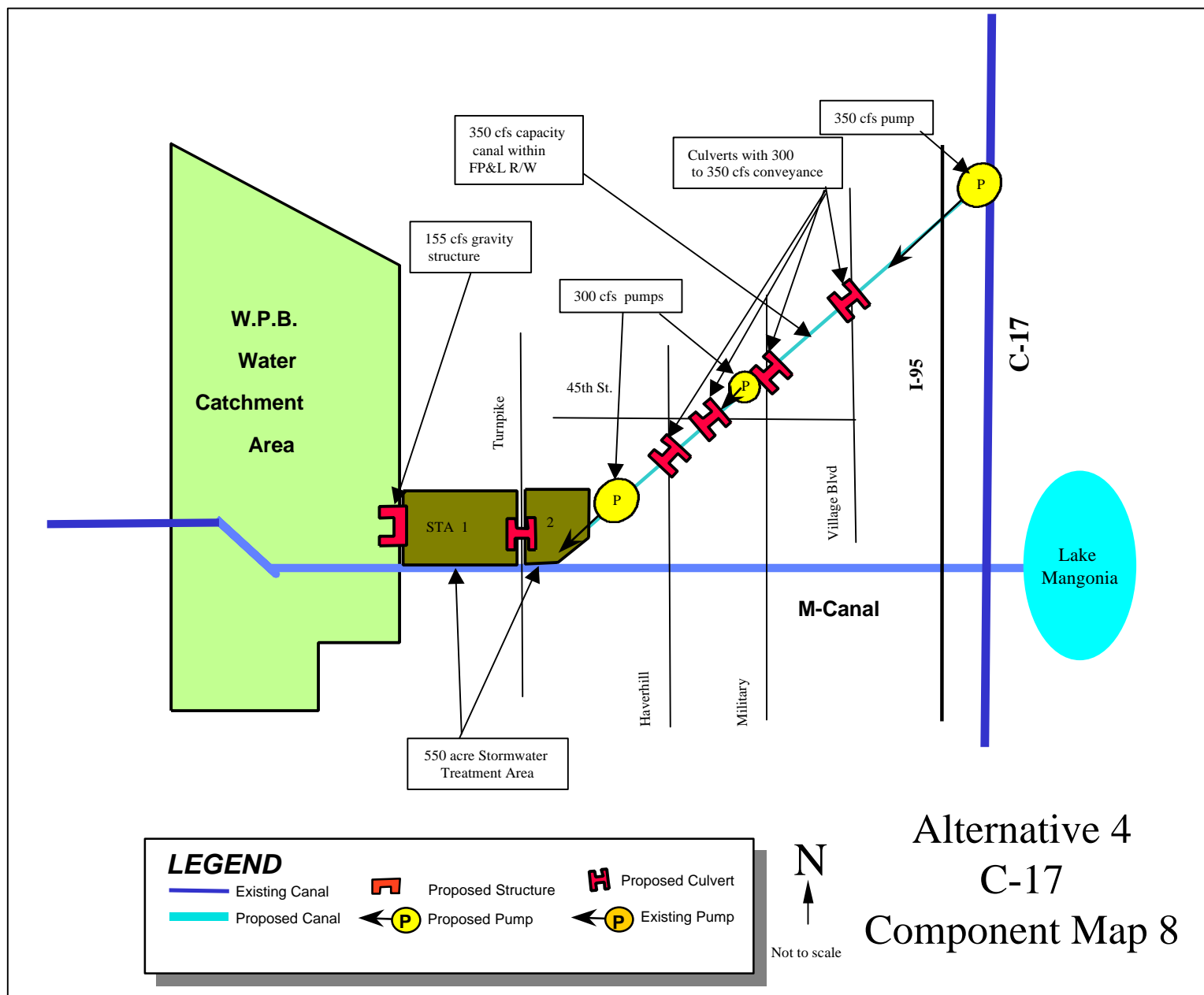
155 cfs gravity discharge structure into West Palm Beach Water Catchment Area

Location: 550 acres located east of the West Palm Beach Water Catchment Area.

Counties: Palm Beach

Assumptions and related considerations:

- (1) Water quality of C-17 water similar to C-51 water quality
- (2) Location of stormwater treatment area south of existing landfill
- (3) Unconstrained canal size within FPL right-of-way



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Component Y3

Geographic Region: Water Catchment Area – Palm Beach County

Component Title: C-51 Backpumping to Water Catchment Area (same as Alternative 3) – SEE COMPONENT MAP 9

Purpose: Reduce water supply restrictions in Northern Palm Beach County Service Area by providing additional flows from the C-51 West Basin to the West Palm Beach Water Catchment Area and enhance hydroperiods in Loxahatchee Slough.

Operation: Capture excess C-51 Canal water to meet urban water supply demands in the North Palm Beach County Service Area. Water would be diverted from C-51 to a water treatment area and then into the Water Catchment Area.

Design: 600 acres at 4 feet maximum depth to be used for stormwater treatment. Relocate the S-155A structure east of the intersection of Lake Worth Drainage District's E-1 Canal and the C-51 Canal and increase the capacity of S-155A from 1000 cfs to 1450 cfs.

Improve conveyance between C-51 and the stormwater treatment area as necessary.

450 cfs inflow pump to stormwater treatment area.

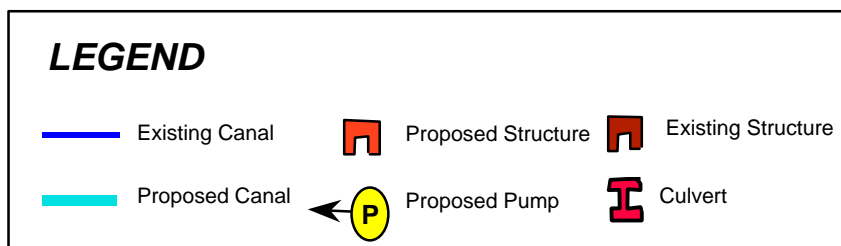
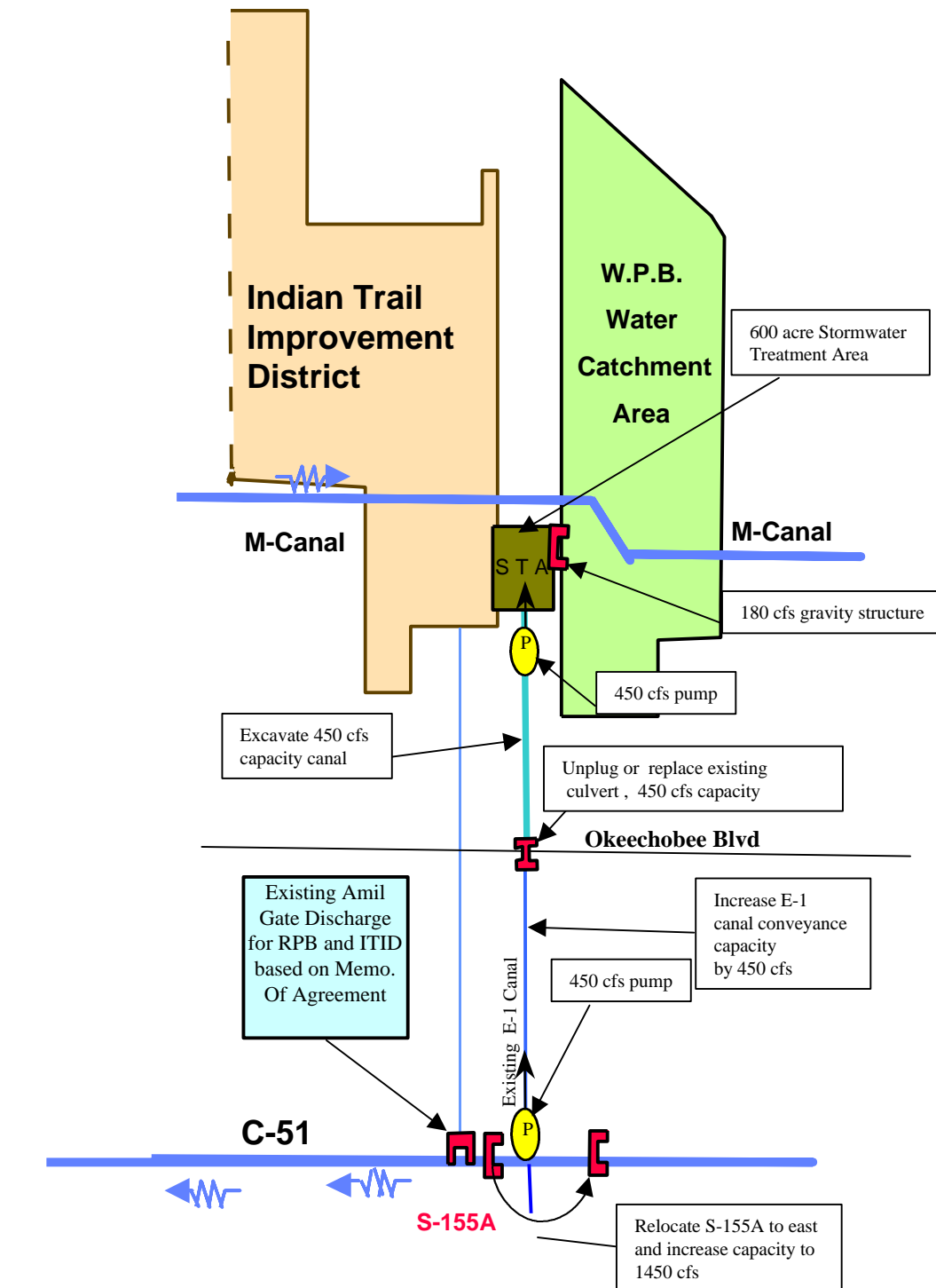
185 cfs gravity discharge structure into West Palm Beach Water Catchment Area.

Location: 600 acres located southeast of West Palm Beach Water Catchment Area.

Counties: Palm Beach

Assumptions and related considerations:

- (1) Uncertainty in land availability.
- (2) Connection of L-8 and C-51 Basins.



Not to scale

Alternative 4 C-51 East Component Map 9

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Component AA3

(not included in Alternative 4)

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Component BB4

Geographic Region: Water Preserve Area - Palm Beach County

Component Title: Dade Broward Levee / Pennsuco Wetlands (same as Alternatives 1, 2 and 3 with the exception of operations) -- SEE COMPONENT MAP 6

Purpose: Reduce seepage to the east from the Pennsuco wetlands and southern Water Conservation Area (WCA) 3B and enhance hydroperiods in the Pennsuco. Also an improved Dade Broward Levee will enhance recharge Miami-Dade County's Northwest Wellfield

Operation: Improvements to the Dade-Broward Levee and associated conveyance system will reduce seepage losses to the east and provide recharge to Miami-Dade County's Northwest Wellfield. Seepage reduction will enhance hydroperiods in Pennsuco wetlands and hold stage higher along southeastern WCA 3B. Recharging the conveyance features of the Dade-Broward levee from the Central Lake Belt In-ground Storage Area (see Component S4) provides recharge to Miami-Dade County's Northwest Wellfield. Treatment areas will be provided to meet all water quality standards required for release from the Central Lake Belt Storage Area if necessary.

Design:

Improve the Dade-Broward Levee:

- Construct or improve existing levee to five-foot height with 2-foot top width while creating or improving existing conveyance to a capacity of up to 300 cfs.
- Provide recharge for the Dade-Broward Levee conveyance system from the Central Lake Belt Storage Area when the Conveyance Channel is below 5.0 feet NGVD at the C-4 structure located at the southern end of the Dade-Broward Levee.

Location: Dade-Broward Levee, Pennsuco Wetlands, WCA-3B, the Central Lake Belt Storage Area and Miami-Dade County's Northwest Wellfield.

Counties: Miami-Dade

Assumptions and related considerations:

- 1) Wellfield protection must be maintain through recharge of acceptable water quality.
- 2) Stormwater Treatment Area of the recharge provided from the Central Lake Belt Storage Area may be needed.
- 3) Secondary structures within the recharge canals may be needed to provide seepage reduction and wellfield recharge desired.
- 4) The stage maintained in the Dade-Broward Levee conveyance is subject to change.

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- 5) Telemetry systems will be required for all operable structures and pump stations.

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Component CC3

Geographic Region: Lower East Coast Service Area

Component Title: Broward County Secondary Canal System (same as Alternative 3) – SEE COMPONENT MAP 10

Purpose: Increase pump capacity of existing facilities (from the 2050 Base Case) for the Broward County Secondary Canal System to provide additional recharge to wellfields located in central coastal Broward County. Construct additional canal and pump facilities to provide additional benefit. Facilities are designed for water supply benefits and capture of excessive storm water discharges to tide.

Operation: When excess water is available in the basin, water is pumped into the coastal canal systems to maintain canal stages. When local water is not sufficient to maintain canal stages, canal stages are maintained first from local sources and then from the regional system. Local sources include the Site 1 Impoundment (Component M), Hillsboro Canal Aquifer Storage and Recovery (ASR) (Component NN) and the North New River ASR (Component OO).

Design:

Canal Conveyance: Improve canal conveyance of secondary canal located east of the Florida Turnpike (herein referred to as the east turnpike canal) from the C-12 Canal south to the Fort Lauderdale Golf and Country Club. Canal conveyance improvements may also be necessary for Old Plantation Water Control District's eastern canal.

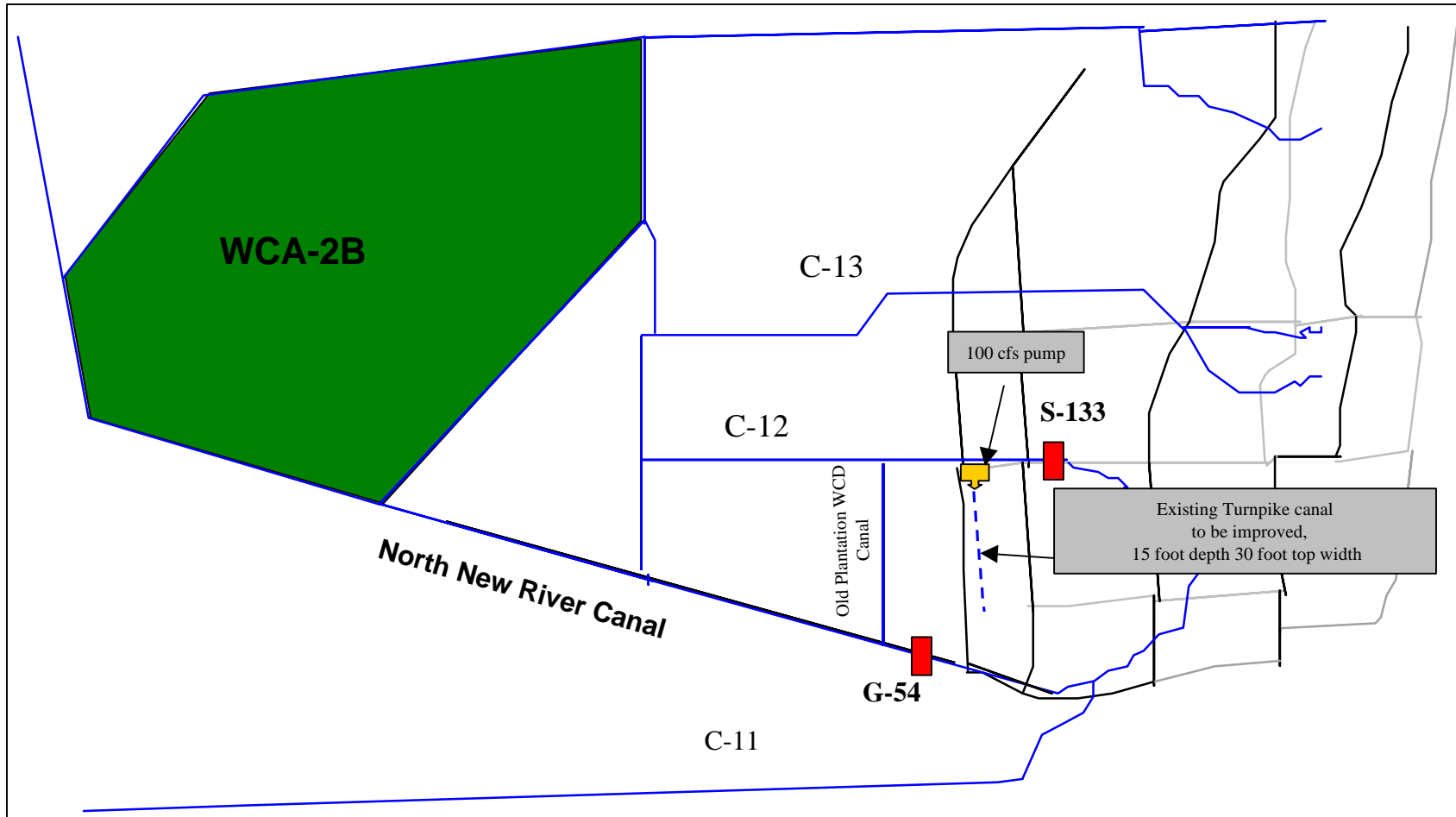
Canal pump Capacities and maintenance levels: Increase pump capacities in the Broward Secondary Canal System for pumps P-2 and P-3 from the existing 33 cfs to 100 cfs. Add an additional 100 cfs pump on the east turnpike canal withdrawing from the C-12 canal. Maintenance level for the canals shall be the same as specified in the Lower East Coast Water Supply Plan. The east turnpike canal shall be maintained at a level similar to the North New River.

Location: Lower East Coast Service Area.

Counties: Broward.

Assumptions and related considerations:

(1) Canal levels are maintained from local basin runoff and local sources. When water is not available from local sources, water is supplied to the canal systems from the regional system.



**Broward County Secondary Canal System
Alternative 4
Component Map 10**

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Component DD3

Geographic Region: Holey Land Wildlife Management Area

Component Title: Revised Holey Land Operational Plan (same as Alternative 3)

Purpose: Improve timing and location of water depths within the Holey Land Wildlife Management Area based on rain-driven operations.

Operation: Rainfall-driven operational rules with NSM-like hydrologic conditions triggering deliveries. Rainfall-driven inflows are driven by NSM water depths in cell R45C18. Outflows are based on NSM water depths in R42C20.

Design: Operational change only.

Location: Southern portion of the Everglades Agricultural Area, north of Water Conservation Area 3A.

Counties: Palm Beach

Assumptions and related considerations:

1) Water deliveries made to the Holey Land through G-200A are assumed to be of acceptable water quality from either Rotenberger or Lake Okeechobee.

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Component EE3

Geographic Region: Rotenberger

Component Title: Modified Rotenberger Regulation Schedule (same as Alternative 3)

Purpose: Improve timing and location of water depths within the Rotenberger Wildlife Management Area based on rain-driven operations.

Operation: Rainfall-driven operational rules with NSM-like hydrologic conditions triggering deliveries. Rainfall-driven inflows and outflows are driven by the average of NSM water depths in cells R46C15 and R43C15.

Design: Operational change only.

Location: Southern portion of the Everglades Agricultural Area, north of Water Conservation Area 3A.

Counties: Palm Beach

Assumptions and related considerations:

1) Water deliveries made to Rotenberger from Stormwater Treatment Area 5 are assumed to be of acceptable water quality

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Component FF4

Geographic Region: Water Preserve Area - Dade County

Component Title: Construction of S-356 A & B Structures (modified from Alternative 3 to include relocation of a portion of L-31N) – SEE COMPONENT MAP 7

Purpose: To improve deliveries to Northeast Shark River Slough in Everglades National Park and reduce seepage to Lower East Coast Service Area 3.

Operation: Redirect Bird Drive Recharge Area flow to Modified L-31N instead of L-29. Redirect S-357 outfall from L-31N to the mid-point of the Modified Water Deliveries (MWD) mitigation canal northwest of the 8.5 Square Mile Area.

Design: Remove MWD S-356
 Relocate MWD S-357
 Add S-356 A & B Structures (900 cfs each) at locations along
 modified L-31N between G-211 and Tamiami Trail
 Reroute L-31N borrow canal to east side of buffer cell
 Relocate L-31N to east side of buffer cell
 Backfill portion of L-31N where levee moved
 5 foot levee along west side of existing lakes

Location: L-31N along east side of Northeast Shark River Slough
 Counties: Miami-Dade

Assumptions and related considerations:

1. Water Quality is not a problem
2. Bird Drive Recharge Area flow is redirected seepage
3. No adverse impacts to areas east of L-31N.

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Component GG4

Geographic Region: Lake Okeechobee

Component Title: Lake Okeechobee Aquifer Storage and Recovery (Lake ASR) (modified from Alternative 3 to use Climate based operational rules)– SEE COMPONENT FIGURE 1.

Purpose: Provides additional regional storage while reducing both evapotranspiration losses and the amount of land removed from current land use (e.g. agriculture) that would normally be associated with construction and operation of above-ground storage facilities (reservoirs);
 Increase the Lake's water storage capability to better meet regional water supply demands for agriculture, Lower East Coast urban areas, and the Everglades;
 Manage a portion of regulatory releases from the Lake primarily to improve Everglades hydropatterns, meet environmental targets within the Water Conservation Areas (WCAs), and meet supplemental water supply demands of the Lower East Coast;
 Reduce harmful regulatory discharges to the St. Lucie and Caloosahatchee estuaries;
 Maintain existing level of flood protection.

Operation: Water from Lake Okeechobee is to be pumped into the Lake Aquifer Storage and Recovery (ASR) wells when the climate-based inflow forecast projects that the Lake water level will rise significantly above those levels that are desirable for the Lake littoral zone (15.0-14.5 feet, NGVD; Figure 1). During the dry season, flow may be made back to the Lake from the ASR wells either when the Lake water level is projected to fall to within three-quarters of a foot of the supply-side management line the same dry season, or below 11.75 feet the upcoming wet season. During the wet season, flow is allowed from the ASR wells to the Lake when climate-based inflow forecast projects less than 1.5 million acre-feet of inflow during the next 6 months, and the Lake water level is either below 11.75 feet (NDVD) during the current wet season, or is projected to be in supply-side management during the upcoming dry season.

Design: 1,000 MGD total: 100, 10-MGD ASR wells and associated infrastructure

Location: Lake Okeechobee peripheral levee

Assumptions and Related Considerations:

(1) Current United States Environmental Protection Agency and Florida Department of Environmental Protection regulations require that ASR source

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water meet primary drinking water standards before injection. Lake Okeechobee water is assumed to meet these standards.

(2) ASRs will have an approximate recovery rate of 70%, i.e. 30% of water injected to the deep wells is lost due to transmission (injection and recovery) and storage (mixing with deep aquifer saline water, migration of ASR storage flume) losses.

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Component HH3

(not included in Alternative 4)

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Component II3

Geographic Region: Everglades Agricultural Area (EAA) - Palm Beach County

Component Title: Pump Station G-404 Modification (same as Alternative 3)

Purpose: Increase the capacity of proposed Everglades Construction Project (ECP) pump station G-404 to improve the hydropattern restoration in the northwest corner of Water Conservation Area 3A (WCA 3A) and increase the amount of water available in the central region to reduce dry out periods.

Operation: Pump the maximum Stormwater Treatment Area (STA) 3/4 treated discharge possible across the Miami Canal from the L-5 borrow canal to the L-4 borrow canal to the northwest corner of WCA 3A. The treated discharge will sheet flow across the northern reach of WCA 3A between the Miami Canal and L-28 and flow down the L-28 canal through structure S-140. This additional water should improve the hydropattern restoration and reduce the number of dry out periods in the central region of WCA 3A. This diversion of water from the northeast section of WCA 3A should reduce the inundation duration and extreme high water depths in this sector of the water conservation area.

Design:

Increase the capacity from 1000 cfs to 2000 cfs on this proposed vertical, axial flow, low head, high capacity pump station (may be slightly resized after further hydraulic analyses).

Location: Confluence of Miami Canal, L-5 Borrow Canal and the L-4 Borrow Canal north of the S-8 Pump Station.

Counties : Palm Beach

Assumptions and related considerations:

- (1) Land Availability.
- (2) Compatibility with proposed G-404 design.
- (3) Modifications to the L-4 and L-5 borrow canals if needed to increase the conveyance capacities to handle the additional conveyance.

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Component JJ3

(not included in Alternative 4)

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Component KK4

Geographic Region: Water Conservation Area 1

Component Title: Loxahatchee National Wildlife Refuge Internal Canal Structures (same as Alternative 3 with the exception of operations)

Purpose: Improve timing and location of water depths in the Refuge.

Operation: Structures would remain closed except to pass Stormwater Treatment Area (STA) 1 East and STA – 1 West outflow and water supply deliveries.

Design:

- (1) L-7 borrow canal structure: 1500 cfs gravity structure at 0.5 foot head.
- (2) L-40 borrow canal structure: 1500 cfs gravity structure at 0.5 foot head.

Location: The L-7 structure is located at cell R28C50 in the L-7 borrow canal within the Loxahatchee National Wildlife Refuge. The L-40 structure is located at cell R34C50 in the L-40 borrow canal within the refuge.

Counties: Palm Beach

Assumptions and related considerations:

- 1) STA discharges to the Loxahatchee National Wildlife Refuge are assumed to be of acceptable water quality.

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Component LL4

Geographic Region: Lower East Coast Service Area 1

Component Title: C-51 Regional Groundwater Aquifer Storage and Recovery (ASR)

Purpose: This is a regional groundwater aquifer storage and recovery system which will capture and store excess water during wet periods and recover the water for utilization during dry periods. The ability to use the recovered water during dry periods will increase regional water resources.

Operation: Water will be captured and stored when water is being discharged out of S-155 to tide. Water will be recovered during dry periods based on canal elevations. Recoverable water is limited to 70 % of injected water.

Design: This component consists of 54 well clusters located along the West Palm Beach Canal (C-51) and the E-4 Canal southward from C-51 to Lake Osborne, each being composed of two (2) surficial aquifer wells and one Upper Floridan aquifer ASR well. The surficial aquifer wells will each have a 2.5 mgd withdrawal capacity and be located in proximity to the canal so that the water withdrawn would result in the interception of water that would otherwise go to tide in wet periods. Each upper Floridan aquifer ASR well will have a capacity of 5 mgd. (The total injection and recovery capacity of the ASR system is 270 mgd.) Water will be injected when stages in the C-51 Canal and the E-4 Canal are above 8.0 feet NGVD. Water will be retrieved from the ASR wells when canal stages are below 7.8 feet NGVD. Recovered water will be discharged to the C-51 Canal.

Location: Along the C-51 Canal in Eastern Palm Beach County east of U.S. Route 441.

Counties: Palm Beach

Assumptions and Considerations: It is assumed that groundwater ASR in proximity to the C-51 canal is permissible without treatment.

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Component MM4

Geographic Region: Lower East Coast Service Area 1

Component Title: Hillsboro Canal Basin Regional Groundwater Aquifer Storage and Recovery (ASR)

Purpose: This is a regional groundwater aquifer storage and recovery system which will capture and store excess water during wet periods and recover the water for utilization during dry periods. The ability to use the recovered water during dry periods will increase regional water resources.

Operation: Water will be captured and stored when water is being discharged from the coastal Hillsboro Canal basin to tide. Water will be recovered during dry periods based on canal elevations. Recoverable water is limited to 70% of injected water.

Design: This component consists of 22 well clusters located along Hillsboro Canal, each being composed of two (2) surficial aquifer wells and one Upper Floridan aquifer ASR well. The surficial aquifer wells will each have a 2.5 mgd withdrawal capacity and be located in proximity to the canal so that the water withdrawn would result in the interception of water that would otherwise go to tide in wet periods. Each upper Floridan aquifer ASR well will have a capacity of 5 mgd. (The total injection and recovery capacity of the ASR system is 110 mgd.) Water will be injected when stages in the Hillsboro Canal are above 7.1 feet NGVD to 22 wells. When water is available from the Site 1 Reservoir (see Component M) it will be supplied for injection to the remaining 15 wells. Water will be retrieved from the ASR wells when canal stages are below 7.0 feet NGVD. Recovered water will be discharged to the Hillsboro Canal.

Location: Along the coastal reach of the Hillsboro Canal in Palm Beach and Broward Counties

Counties: Palm Beach, Broward

Assumptions and Considerations: It is assumed that groundwater ASR in proximity to the Hillsboro Canal is permissible without treatment.

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Component NN3

(not included in Alternative 4)

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Component OO4

Geographic Region: South Dade County

Component Title: Modification to South Dade in Southern Portion of L-31N and C-111 (same as Alternative 3 with the exception of operations)

Purpose: To improve deliveries to Everglades National Park and decrease potential flood risk in the lower east coast service area.

Operation: Implement Phase I Experimental Program of Water Deliveries to Everglades National Park operations (95 Base conditions).

Design: S-332D at 500 cfs
 Remove S-332B
 Add 100 cfs to S-332C (keep total of S-332 A-D < 1200 cfs)
 Remove S-332 pump station
 Remove S-332D Tieback canal which provides flow from C-111 to S-332.

Location: South Dade Conveyance System
 Counties: Miami-Dade

Assumptions and related considerations:

1. Will not cause adverse impacts to ENP and South Dade Agricultural Lands.
2. This component is dependent on Component FF.

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Component PP3

(not included in Alternative 4)

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Component QQ4

Geographic Region: Water Conservation Areas and Everglades National Park

Component Title: Decompartmentalization of Water Conservation Area 3

Purpose: Remove flow obstructions to achieve uncontrolled flow between Water Conservation Areas 3A and 3B and Northeast Shark River Slough and reestablish the ecologic and hydrologic connection between these areas.

Operation: Sheetflow to Everglades National Park (refer to Component H4 for Everglades Rain-Driven Operations). Removal of rain-driven trigger gages in Northeast and Northwest Shark River Slough. Removal of the 3A-28 import trigger for bringing water from Lake Okeechobee.

Design: Remove the L-28 and L-28 tieback Levees, the L-29, L-67A, L-67C and L-68A levees and all associated water control structures
Backfill the Miami Canal to one to two miles south of the S-8 pump station

Location: Within the existing boundaries of the Water Conservation Areas and Everglades National Park.
Counties: Broward, Miami-Dade

Assumptions and related considerations:

- 1) Potential increases in hydropatterns in dry areas and decrease in hydropatterns in deep water areas.
- 2) Tradeoff between water levels and hydroperiods in central and south central Water Conservation Area 3A and Everglades National Park.

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Component RR4

Geographic Region: Water Conservation Areas

Component Title: Flow to Central Water Conservation Area 3A (WCA 3A)

Purpose: To increase depths and extend hydroperiods in central WCA 3A.

Operation: Relocate pump station S-140 and distribute flows into central WCA 3A. Pump operation will be driven by target stages at the 3A-4 gage.

Design: Relocate S-140 pump station approximately 8 miles south of its current location and increase the capacity from 1300 cfs to 2000 cfs. A spreader system will be needed to distribute the S-140 discharge via sheetflow.

Location: Within the existing boundaries of the Water Conservation Areas.

Counties: Broward

Assumptions and related considerations:

- 1) Potential increases in hydropatterns in dry areas and decrease in hydropatterns in deep water areas.
- 2) Tradeoff between water levels in indicator regions 18 and 17 in central WCA 3A.
- 3) May require increased flows from Lake Okeechobee to achieve the desired hydropatterns in central WCA 3A.
- 4) Spreader mechanism required at the point where flows will be introduced into WCA 3.

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Component SS4

Geographic Region: Everglades Agricultural Area (EAA) and Miami-Dade County

Component Title: Reroute Miami-Dade County Water Supply Deliveries – SEE COMPONENT MAP 11

Purpose: Reroute water supply deliveries made to Miami-Dade County from the Miami and Tamiami Canals and Water Conservation Area 3 (WCA 3) to the North New River Canal due to the backfilling of the Miami Canal as part of the decompartmentalization of WCA 3.

Operation: Send water supply deliveries from Lake Okeechobee to Miami-Dade County southeast through the North New River Canal in the Everglades Agricultural Area (EAA) (L-20, L-19, L-18) to S-150. From S-150 send deliveries into L-38W and at the southern terminus of L-38W south through a 1500 cfs pump to the borrow canal along the west side of US 27.

Design:

Double the capacity of the North New River Canal south of the proposed EAA Storage Reservoir (see Component G3) to convey additional water supply deliveries to Miami-Dade County as necessary.

Double the capacity of S-351 and S-150 to pass additional water supply deliveries to Miami-Dade County as necessary.

Improve conveyance in the borrow canal on the west side of US 27 between L-38W and the Miami Canal as necessary to pass the additional flows.

Location: EAA and Water Conservation Area 3.

Counties: Palm Beach, Broward, Miami-Dade

Assumptions and related considerations:

- 1) Operational flexibility is reduced since there is only one delivery route to Miami-Dade County (back-up routes have been eliminated).

1500 cfs Inverted Siphon to pass water supply deliveries from L-38 borrow canal to US 27 west borrow canal (improved to pass additional flows). Maintains separation of Lake Okeechobee deliveries and WCA 2 seepage water.

3 structures, 800 cfs at 4 feet of head, (S-141 A, B, C) to pass flows greater than NSM to NESRS and/or CLBS via improved conveyance of NNR, L-37 and L-33 canals.

Basin Divide structure to separate WCA-2B flows directed south

2000 cfs pump and culvert to convey flows generated by both seepage collection and flows above NSM in WCA 2B from NNR to the L-37 borrow canal

New levee to be constructed from North New River south to the Miami Canal



US 27 west borrow canal

Basin Divide structures to separate WCA -2B flows directed south. 500 cfs structure to be used for water supply releases to Broward County

Alternative 4 North New River Component Map 11

↑ N
Not to Scale

LEGEND

	Existing Canal		Improved Canal
	Existing Levee		New Levee
	Existing Water Control Structure		New Water Control Structure
			New Culvert

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Component TT4

(not included in this Alternative)

L-35B (component TT4) is the levee separating WCA-2A and WCA-2B. Simulation results showed that removal of L-35B caused several unintended consequences that could not be overcome by significantly increasing the supply of Lake Okeechobee water to WCA-2A. These unintended consequences included:

- a. excessive lowering of central & southern WCA-2A water levels
- b. excessive shortening of WCA-2A hydroperiods
- c. excessive lowering of Lake Okeechobee stages
- d. excessive increase in Lake Okeechobee service area demands not met
- e. marginal improvement in hydropatterns in ENP

To illustrate the severity of these unintended consequences, a scenario (Alternative 4 without L-35B) will be posted on 2/25.

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Component UU4

Geographic Region: St. Lucie/C-23, C-24, Northfork and Southfork Basins

Component Title: Storage Reservoir (Alternative 4 is first to contain this component)

Purpose: Storage reservoir to capture local runoff from the C-23, 24, and Northfork and Southfork Basins of the St. Lucie River Estuary. The reservoir will be designed for flood flow attenuation to the estuary, water supply benefits including environmental water supply deliveries to the estuary, and water quality benefits to reduce salinity and nutrient impacts of runoff to the estuary.

Operation:

Inflows from C-23, C-24 and Northfork and Southfork of the St. Lucie River.

Design:

16,500 acres at 10 feet maximum depth

Inflow pump capacity = TBD (initially assumed to not constrain performance)

Outflow structure capacity = TBD (initially assumed to not constrain performance)

Location: To be determined – Specific site not necessary for Water
Management Model simulation
Counties: Martin and St. Lucie

Assumptions and related considerations:

(1) Uncertainty in land availability

(2) Potential water quality benefits by reducing nutrient loading to the estuary

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Component VV4

Geographic Region: Central Eastern Palm Beach County

Component Title: Palm Beach County Agriculture Reserve Reservoir (new component) – SEE COMPONENT MAP 12

Purpose: Increase water supply for central and southern Palm Beach County by capturing and storing water currently discharge to tide.

Operation: The reservoir will be filled during the wet-season from excess water pumped out of the western portions of the Lake Worth Drainage District (LWDD) (backpumped). Water will be released back to LWDD to maintain canal stages during the dry-season. As with the base cases and the previous alternatives regional water will be supplied to the LWDD when water levels fall below 15.8 feet NGVD. Water will be backpumped into the reservoir when water levels are above 16.00 feet NGVD. Water will be supplied from the reservoir before tapping water from Aquifer Storage and Recovery (ASR) systems. Specifically, the water supplied from the reservoir will be maximized (up to the outflow capacity) before water is supplied from ASR storage.

Design:

1,660 acres with a maximum depth of 6 feet

Inflow pump capacity = 500 cfs (provided by two 250 cfs pumps)

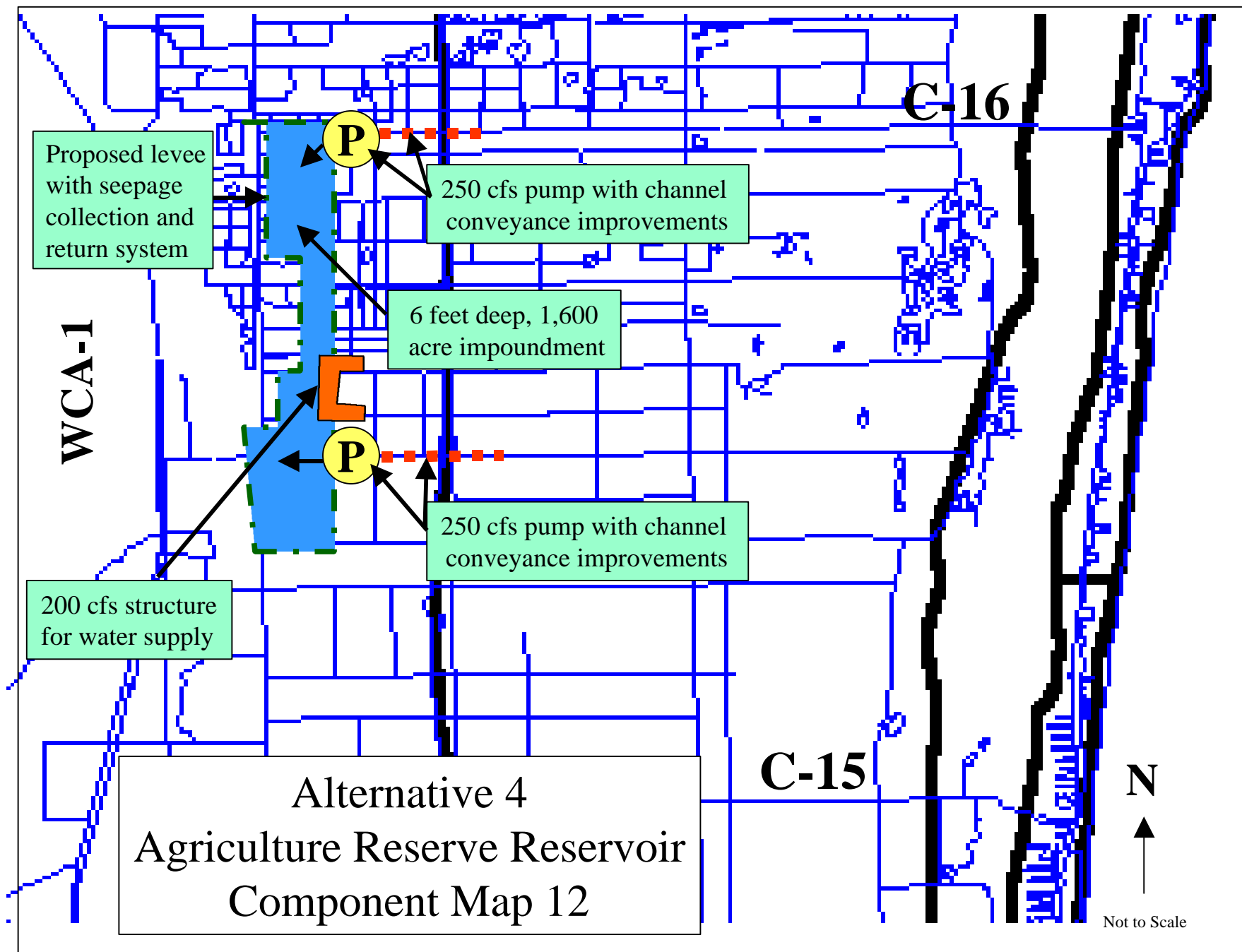
Outflow structure capacity = 500 cfs @ 4 ft. head

Emergency outflow structure = 300 cfs

Location: The western portion of central Palm Beach County.
Counties: Palm Beach

Assumptions and related considerations:

- (1) Excess storage could be discharged to the LWDD during off peak times.
- (2) Canal conveyance improvements for two laterals from E-1 to the E-2.
- (3) No operation changes in the LWDD.



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Component WW4

Geographic Region: South Dade County

Component Title: C-111N Spreader Canal – SEE COMPONENT MAP 13

Purpose: To reduce wet season flows in C-111, improve deliveries to Model Lands and Southern Glades and decrease potential flood risk in the lower south Dade area.

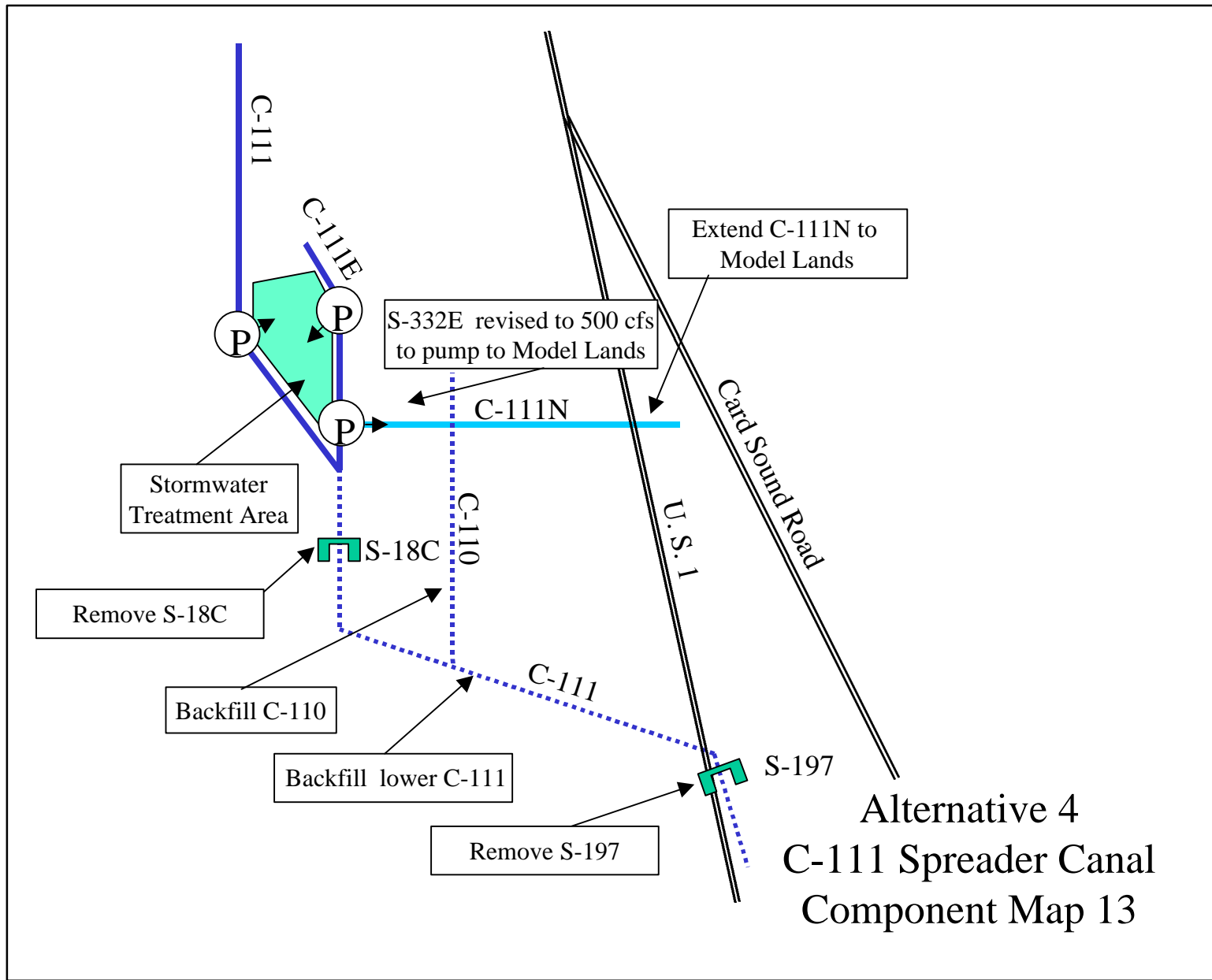
Operation: Water is pumped from C-111 and C-111E into a Stormwater Treatment Area (STA) prior to pumping through S-332E into C-111N to Southern Glades and Model Lands. S-197 and S-18C are removed and C-111 is backfilled.

Design: Increase S-332E to 500 cfs from 50 cfs (pump when available)
 Relocate C-111N to SW theoretical 440th street (approximately 1
 section north)
 Culvert under US 1
 Canal into triangle area of Model Lands
 Fill in C-111 south of confluence with C-111N to S-197
 Remove levees and access roads
 Complete backfill C-110
 Create STA in triangle land between C-111 and C-111E to clean
 water prior to putting in Model Lands

Location: South Dade Conveyance System
 Counties: Miami-Dade

Assumptions and related considerations:

1. Will not cause adverse impacts to South Dade Agricultural and Urban Lands.
2. Assume clean water from C-111 and C-111E



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Component XX4

Geographic Region: Water Preserve Area - Dade County

Component Title: North Lake Belt Storage Area - SEE COMPONENT MAP 6

Purpose: In-ground reservoir to capture a portion of runoff from western C-6, western C-11 and C-9 Basins. The in-ground reservoir with perimeter seepage barrier will allow storage of untreated runoff without concerns of ground water contamination. The stored water will be used to maintain stages during the dry season in the C-9, C-6, C-7, C-4 and C-2 canals.

Operation: Inflows from C-6 (west of the proposed divide structure), western C-11, and C-9 basin runoff are pumped and gravity fed into the in-ground reservoir. Inflow ceases when stages reach ~5.0 feet NGVD (0 feet above adjacent land elevation).

Outflows for water supply are pumped to the C-9 Storm Water Treatment Area (STA)/Impoundment prior to delivery to the C-9, C-6, C-7, C-4 and C-2. Canals.

Water from the reservoir can be withdrawn down to a stage of B15 feet NGVD (up to 20 feet of working storage & maximum head on seepage barrier).

(Note: SFWMM simulation assumes 5120 acres of surface area. To simulate equivalent working storage volumes, the simulated water levels are higher from those prescribed here.)

Design:

Reservoir: 3,500 acres with subterranean seepage barrier around perimeter to enable drawdown during dry periods, prevent seepage and to prevent water quality impacts.

Inflow Structures: 2500 cfs gravity structure @0.5 ft head, from C-11W
600 cfs pump from C-9
100 cfs pump from C-6 west of divide structure

Outflow Structures: 1000 cfs pump to C-9 STA/Impoundment for treatment prior to deliveries to C-6, C-2, C-4 and C-9 to prevent saltwater intrusion in coastal canals. (Stormwater Treatment Area detention time requirements need to be addressed. Pretreatment in reservoir may reduce size requirements of treatment area).

Canal: 800 cfs canal capacity - Water supply discharges are routed to C-4/C-2 via a canal to be located east of the Snapper

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Creek canal (Northwest wellfield protection canal system).
2-1400 cfs delivery structures, one each at the new canal's
confluence with C-6 and C-4. SEE COMPONENT MAP 6

Location: Reservoir would be located within the area proposed for rock mining by the Lake Belt Issue Team. It would be sited north of Miami Canal (C-6) and South of the C-9 Canal to minimize impacts to the Northwest wellfield.

Counties: Dade

Assumptions and related considerations:

- 1) No adverse effect of a subterranean wall on Dade County's NW wellfield
- 2) Treatment facility needed if stored water is backpumped to the Everglades.
- 3) All water quality considerations will be addressed regarding releases from the reservoir to the water supply wellfields.
- 4) Impacts on the cone of influence of the Northwest Wellfield and its effect on wetland mitigation around the wellfield.
- 5) Limestone Filter Treatment system within the Reservoir may be developed through use of compartmentalization of rockmining excavation pattern.
- 6) Telemetry systems will be required for all operable structures and pump stations.

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Component YY4

Geographic Region: Water Conservation Area -Water Preserve Area - Lake Belt

Component Title: Divert WCA2 flows to Central Lake Belt Storage - SEE
COMPONENT MAP 11

Purpose: Capture excess in Water Conservation Area 2B (WCA 2B) to reduce stages above NSM in Water Conservation Area 2B and to divert water through improved L-37 and L-33 Borrow Canals to 1) North East Shark River Slough (NESRS) to meet targets or 2) Central Lake Belt Area for deliveries to NESRS, or 3) when available to meet Snapper Creek demands and 4) to maintain Dade-Broward levee at 5.0 feet NGVD.

Operation: Surface water in WCA 2B above NSM will overflow through 3 structures along L-35 and L-35A to North New River Canal along with seepage from WCA 2B and pumped to L-37. North New River Canal, L-37 and L-33 Borrow Canals will be improved to accept this additional flow along with the seepage collected from WCA 3. This water will be pumped to North East Shark River Slough (NESRS) if the Slough is below target levels **or** into a lined reservoir south of the confluence of L-33 and the C-6 Canal referred to as the Central Lake Belt Storage Area (CLBSA) SEE COMPONENT S. Water in the CLBSA will be used to 1) meet NSM targets in NESRS, 2) provide water for Snapper Creek Canal and 3) provide water to the Dade-Broward Levee to maintain 5.0 feet NGVD.

Design:

- (1) 3- diversion structures with 175 cfs capacity @0.5 feet of head and 500 cfs capacity @4.0 feet of head along the southern perimeter of WCA 2B
- (2) Intermediate 1500 cfs pump station to divert overflow and seepage from NNR to L-37
- (3) Improved conveyance of L-37 and L-33 to 3000 cfs to handle WCA 2B flows plus seepage from WCA 3
- (4) Remove S-9XN and S-9XS or improve structures to accommodate increased flows.

Location: The overflow structures are located along the southern levee of WCA-2B. L-37 and L-33 Borrow canal improvements are located east of the Protective levees and 0.5 miles west of US 27 between North New River Canal and the Miami Canal.

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Counties: Broward

Assumptions and related considerations:

- 1) Prioritization of use of Central Lake Belt Storage Area water.
- 2) Telemetry systems will be required for all operable structures and pump stations